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Washington Highlights

Uppermost in the minds of petroleum industry representatives in Washington is the impending decision by the Supreme Court on the tidelands issue.

The first serious challenge to the title of states to its tidelands was prompted by Harold L. Ickes, former Interior Secretary and Petroleum Administrator for War. His action is construed as in keeping with the philosophy of the New Deal.

In anticipation of a ruling against the state, more than 200 applications for Federal leases on Pacific Coast tidelands are understood as on file with the Interior Department. It is beyond the ken of competent reckoning at this time to compute the loss to the California oil industry and the consequent chaos in industrial life generally in the event Federal title is given tidelands.

President Truman vetoed the tidelands quit-claim bill some months ago after the measure was considered and passed by Congress in the national interest. When he vetoed the bill Mr. Truman sought to explain his action by asserting that Congress was in error in taking legislative action in respect to the tidelands question in view of earlier action pending in courts.

Industrial leaders and patriotic citizens, however, joined in pointing out an evident misunderstanding on the part of the President to the true facts bearing on the tideland question as the measure had the attention of Congress before the issue was ever presented to the Supreme Court.

The House surplus property committee has reported favorably on permanent use of the Big and Little Inch pipelines for natural gas.

Appointment of Max W. Ball of Denver as acting director of the oil and gas division of the Department of Interior, has been announced by Interior Secretary Krug. He succeeded Ralph K. Davies, who resigned.

Ball was special assistant to Davies throughout the war, when Davies was Deputy Petroleum Administrator for War under Harold L. Ickes. The oil and gas division is the peacetime successor to PAW, which wound up its affairs and came to an end last May 8.

The fiscal year is less than half gone, but Government operations are again in the black. In short, income is running higher than spending.

Tax receipts on December 19 swelled by quarterly payments, turned a deficit of $79,324,000 for the business year into a surplus of nearly $176,965,000 for a single day. This was the first time in years that the Government had a surplus at mid-fiscal year.

The last time the Government was out of the red in the current fiscal year was in late September.

The anti-trust division of the Justice Department has recommended dismissal of the six-year-old anti-trust suit against the American Petroleum Institute and more than 200 oil companies.

Attorney General Clark was said to be holding up dismissal of the case pending a settlement of legal problems. His decision is expected any day.

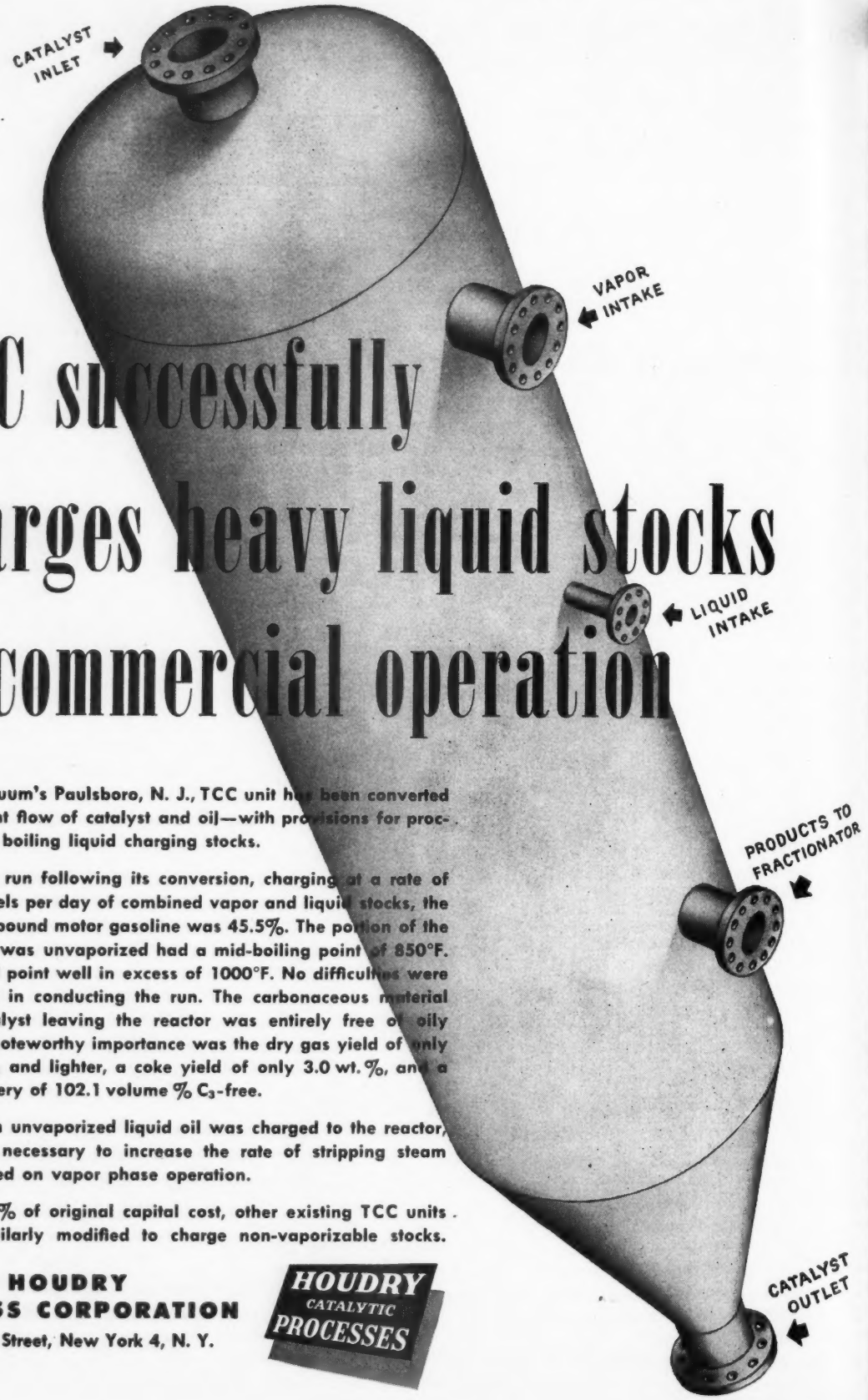
James A. Farley, former Democratic national chairman and now chairman of the board of Coca Cola Export Corp., believes strongly that the Bourbons can make a real showing in 1948. He stressed, however, that only by the infusion of new blood in the organization can the party make a real fight in the national election year.

A reduction in stripper oil well subsidy payments, effective December 1, was the subject of an order issued by the Office of Temporary Control. This move will eliminate all such payments except for Pennsylvania crude oil.

It was explained that the recent general increase in the price of crude oil from 10 to 20 cents a barrel, brought the price in most areas of the country to a level on parity or above the limit of subsidy rates.

Heartening news on the domestic side of the Washington picture was an estimate made by Major General Philip H. Fleming, which saw enough material during 1947 to build at least 1,000,000 homes. This is 300,000 more than in 1946.

Fleming, chief of the Office of Temporary Control, offered this prediction to a Senate small business subcommittee.



TCC successfully charges heavy liquid stocks in commercial operation

Socony-Vacuum's Paulsboro, N. J., TCC unit has been converted to concurrent flow of catalyst and oil—with provisions for processing high boiling liquid charging stocks.

On the first run following its conversion, charging at a rate of 10,000 barrels per day of combined vapor and liquid stocks, the yield of 10 pound motor gasoline was 45.5%. The portion of the charge that was unvaporized had a mid-boiling point of 850°F. with an end point well in excess of 1000°F. No difficulties were encountered in conducting the run. The carbonaceous material on the catalyst leaving the reactor was entirely free of oily matter. Of noteworthy importance was the dry gas yield of only 3.9 wt. % C_3 and lighter, a coke yield of only 3.0 wt. %, and a liquid recovery of 102.1 volume % C_3-free.

Even though unvaporized liquid oil was charged to the reactor, it was not necessary to increase the rate of stripping steam formerly used on vapor phase operation.

For about 1% of original capital cost, other existing TCC units can be similarly modified to charge non-vaporizable stocks.

HOUDRY PROCESS CORPORATION
25 Broad Street, New York 4, N. Y.

HOUDRY CATALYTIC PROCESSES

Multi-stage Centrifugal Compressor Applications

By T. R. Foster,
Clark Bros. Co., Inc.

December Meeting

In recent years there have been large capacity increases in oil industry and chemical process industry gas and air compression requirements.

New processes have been introduced that likewise require larger capacity compression equipment. Consideration of centrifugal compressors has followed as a natural outgrowth of this higher capacity trend. Centrifugal compressors have their greatest economic significance in high capacity applications.

In the past, high capacity centrifugals were synonomous with high volume as most centrifugal blower applications operated at discharge pressures below 50 lbs.

In the centrifugal compressor field, high capacity may imply higher weight flows due to high gravity or higher pressure with its attendant lower relative volume.

High pressure centrifugal compressors will ofttimes be employed in smaller inlet volume applications than has heretofore been economically feasible in centrifugal blower practice as the shaft horsepower will be high enough for a commercial centrifugal application.

The term compressor, in this instance, is used to signify a machine of radial design (Fig. 1) incorporating two or more shrouded type impellers in series discharging gas or air at pressures in the range of 0 to 500 lbs. per square inch.

The tabular presentation (Fig.) covers a so-called line of such compressors, covering a range of 000 to 60,000 cfm. inlet volume and maximum discharge pressures from 110 lbs. per square inch to 300 s. per square inch in semi-steel. n additional number 1½, 13½ ch diameter impeller compressor ermits us to accommodate lower olumes and higher discharge pressures. The smaller size machines e available with steel cases which so permit somewhat higher discharge pressures.

Since these machines are not intended for duties of 200,000 to 300,000 cfm. inlet volume, that might more economically served by an axial flow type blower, they may be said to have an economic upper limit of capacity of 120,000 cfm. and 22,000 horsepower. Horsepowers of this magnitude are accommodated by utilizing the drive-through principle. (Fig. 3).

The lower limits of capacity will have to be resolved more often, and since the compression through the compressor results in a reduction in volume, the exit volume is the limiting factor.

Five hundred cfm. exit volume and five hundred horsepower per case, or stage of compression, are round numbers that may be used as a yard stick in determining whether a non-refrigerating duty warrants a centrifugal compression investigation. Fifteen hundred cfm. minimum inlet volume may be considered as a similar yard stick.

A few applications employing direct steam turbine drives exhausting live steam to process may prove economically feasible down to 300 horsepower, but most commercial applications may be expected to fall in the 500 horsepower and higher capacity range.

Utility and driver costs vary to the extent that it is an impossibility to make factual statements regarding gas or air compression duties that might profitably be served by centrifugals.

In general large capacity centrifugal air compressors find their greatest usage where fuel cost is low. This is true in the case of blast furnace blowers and fluid cat-cracking units. On the other hand, many municipal and manufactured gas duties have been and are being accommodated by centrifugals.

Centrifugals are standard equipment in the steel industry for many applications such as: blowing of blast furnaces, Bessemer convertors, cupolas, and coke oven exhausters and/or boosters.

For refrigeration industry applications in the range of 200 horsepower and upwards the centrifugal compressor is rapidly becoming the standard rather than the alternate type of equipment. A very high numerical proportion of multi-stage centrifugal ompressors operating in the United States are employed on refrigeration cycles. The first units installed were in the capacity range of 50 to 200 horsepower per unit. They were not sold as refrigeration units in competition with current competitive machinery but as part of a system in which the buyer was interested in temperature and humidity guarantees rather than cost of machinery components.

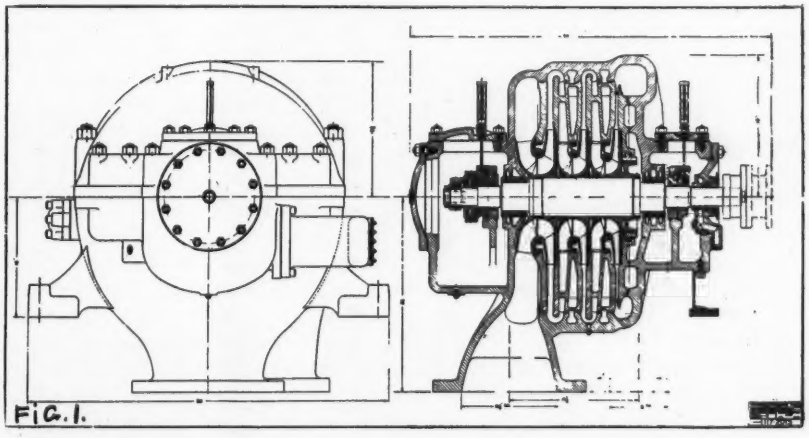


FIG. 1.

MULTI-STAGE CENTRIFUGAL COMPRESSORS—Standard Sizes

	MODEL	NO. 2 COMPRESSOR				NO. 3 COMPRESSOR			NO. 4 COMPRESSOR			NO. 5 COMPR	
	STAGES	3	4	5	6	3	4	5	3	4	5	3	4
CAPACITY—CFM—Approx. Maximum		7000	7000	7000	6000	18000	18000	14000	32000	32000	25000	60000	60000
CAPACITY—CFM—Approx. Minimum		2000	2000	2000	1700	6000	6000	4500	12000	12000	9300	24000	24000
TOTAL WEIGHT—Lbs.		7400	7950	8500	9050	13400	15000	16600	23500	27000	30300	48000	55000
NORMAL SPEED—RPM		9800	9800	9800	8300	7350	7350	5700	5500	5500	4300	4150	4150
SUCTION OPENING—Dia. In.				12			20			30			36
DISCHARGE OPENING—Dia. In.				8			14			20			24
IMPELLER—Dia. In.				18			24			32			42½
INTAKE PRESS—PSIG				150			100			80			60
DISCHARGE PRESS—PSIG				300			200			150			110
MAX. SHAFT HORSE POWER				7000			10000			15000			22000

FIG. 2.

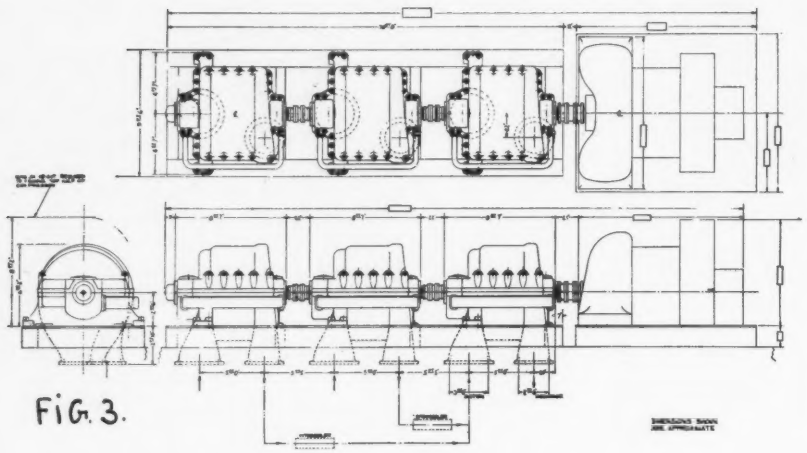


FIG. 3.

Many of the refrigeration units in industries requiring steam for heating purposes employ back pressure turbines exhausting steam for process. Approximately 40% of the centrifugal refrigeration compressors in use utilize steam turbine drivers of different types.

Some 60% utilize electric motors through speed increasing gears.

Refrigeration units that operate on summer air conditioning are quite often driven by the steam that is available for winter heating of plant or building Both low and high pressure condensing type steam turbines are in such use.

The following slides are introduced because they have historical significance in the development of compressors suitable for petroleum industry applications.

The machines shown were designed by our Mr. W. E. Trumpler who has since designed the Clark line of centrifugals.

(Fig. 6) This installation was probably the first centrifugal refrigeration installation in the United States Refining Industry. The two units employ 450 horsepower electric motor drivers and have operated for the past eight years on brine cooling duty at the Standard of New Jersey Refinery at Bayway. Operating experience on these units has been highly satisfactory insofar as the centrifugal compressors are concerned. Periodic exchanger tube failures have indicated the desirability of using standard oil industry type heat exchangers and cheaper petroleum industry type refrigerant as the exchanger maintenance and refrigerant replenishment has been excessive.

(Fig. 7) This is probably the first United States mixed petroleum hydrocarbon gas compression installation operating from atmospheric pressure to discharge pressure above 100 lbs. per square inch. The discharge pressure is 125 lbs. gauge, four compressors of approximately 1300 horsepower each direct connected to steam turbines exhausting to process are involved. The machines operate on 40 molecular weight gas in the Cities Service butadiene plant at Lake Charles, Louisiana.

Some operational difficulties were encountered. The last report we have was last December at which time water was being constantly drained from the lube oil of one of the low stage units and one set of the machines had been operating continuously for five months. Experience gained in handling this humidity laden gas points to the advisability of isolating the bearing chambers when excessive water is present in the gas stream. Auxiliary oil pumps were not, but probably should have been, incorporated in the installation.

(Fig. 8) This is probably the first United States centrifugal air compressor installation compressing air from atmospheric pressure to pressures above 200 lbs. per square inch. Three stages of uncooled centrifugals are used with interstage cooling between stages. Two 2000 horsepower 3 impeller machines on the first stage operate in parallel, one 4000 horsepower 3 impeller machine operates on the second stage and two 3000 horsepower 4 impeller machines operate on the third stage. The machines are synchronous motor driven through speed increasing gears. The air stream is kept free of oil by isolating the bearing chambers and three stage compression was successfully employed with machines operating in parallel and in series on a common air stream. The installation is located at the Aberdeen, Maryland, supersonic ballistic research laboratory.

(Fig. 9) These machines are probably the first United States centrifugal refrigeration machines employing petroleum hydrocarbon as the refrigerant medium. They operate on lean oil chilling at the La Gloria Plant near Corpus Christi Texas. The machines are direct driven by 375 horsepower steam turbines, and are significant of the trend to petroleum hydrocarbon refrigerants in centrifugal compressors.

(Fig. 10) This is the first test centrifugal compressor manufactured by Clark Bros. It is specifically designed for high pressure duty in the petroleum and allied industries.

During the past year a considerable number of high pressure compressors have been ordered by the petroleum industry. Quite a few propane refrigeration compressors have been ordered for lube oil dewaxing. One of the orders we have received embodies 21 compressors

WeldELLS

for example:

selective reinforcement

The bursting stresses in an elbow subjected to internal pressure are known to be greatest at the crotch or inner arc. Mathematical calculations (see formula below) show how much greater the stress is in this region of an elbow, and the calculations have been closely confirmed by experiments.

This is taken into consideration in forming WeldELLS. As shown in the sectional illustration, extra wall thickness is provided at the inner arc to offset the added stress imposed.

There is no better evidence than this of the extra lengths we have gone to in engineering WeldELLS for full strength throughout. But there are plenty of other evidences of extra operations—extra value—that are yours only in WeldELLS and other Taylor Forge fittings for pipe welding.

A number of these extra value features are listed opposite. Combined only in the fittings that "have everything", these features mean greater soundness, speed and economy when your pipe welding is done the WeldELL way.

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WeldELLS alone combine these features:

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

★ The amount by which stress is greater at the crotch in a fitting having uniform wall thickness depends only on its radius. Mathematical analysis (specifically the Lorenz formula) shows the stress at the crotch to be:

$$S = \frac{pr\,(2R - r)}{2t\,(R - r)}$$

WHERE:
S = Bursting stress, lbs. per sq. in.
p = Internal pressure, lbs. per sq. in.
r = ½ inside diameter of fitting (O.D. if Barlow's formula is desired).
t = Wall thickness in inches.
R = Center line radius of fitting, inches.

have everything

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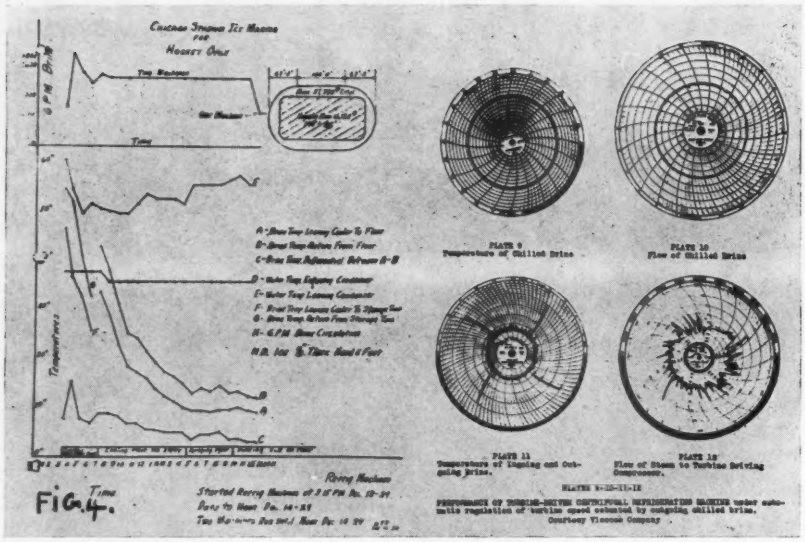

FIG. 4.

totaling over 70,000 horsepower. Air, oxygen, propane, and mixed petroleum hydrocarbons are involved. The oxygen is to be compressed to 290 psia and the mixed hydrocarbons to 275 psia. Centrifugal manufacturers have orders for other duties such as the compression of ethylene, propylene, and sulfur dioxide. A number of these machines will go on stream in the not too distant future.

It is apparent that centrifugal compressors have gained a certain degree of acceptance in the petroleum industry, and petroleum engineers are hence becoming interested in the theory and machine characteristics.

The pertinent theory and operating characteristics are not similar to reciprocating compressor characteristics and attempts to evaluate the operating characteristics of either from the other viewpoint is confusing.

Fortunately, most petroleum engineers are familiar with centrifugal liquid pumps and approach from the liquid pump viewpoint rather than the reciprocating gas compressor viewpoint may help engineers to properly evaluate the machines. The centrifugal compressor may be called a multi-stage gas pump if you wish.

Professor Church has published a text in which he combines centrifugal pumps and compressors and successfully covers both due to the similarity of the underlying theory.

There is one marked difference however. As in the case of gas transmission as compared with liquid transmission, volume is an additional variable that makes selections and calculations somewhat more complicated than liquid pump selection. (Fig 12) The comparative volume, temperature and head characteristics make an interesting comparison.

Head of a pump or compressor, hydraulically speaking, is the number of feet of the medium being pumped, that the unit will sustain while delivering its rated capacity. It may add to clarity to visualize a 4 stage water pump, that takes suction at 0 lbs. per square inch gauge and discharges at 800 lbs. per square inch gauge, capable of sustaining a water column 1848 feet in height or 1 lb. per square inch gauge for each 2.31 feet of water. In the liquid pump the pressure rise per impeller is essentially the same. Temperature effect on volume and head is approximately constant on all impellers as the temperature rise is negligible. Temperature is therefore neglected on the chart and volume is constant at 100% GPM as illustrated.

The comparative 4 stage centrifugal air compressor illustration is not of the same scale as the liquid pump illustration, the magnitude of heads being too divergent for identical scale representation. Note that 37,200 feet of air, at adiabatic compression conditions, is equivalent to 24.3 lbs. per square inch pressure differential while only 1848 feet of water is equivalent to 800 lbs. per square inch gauge pressure differential.

2.8 pressure ratio is taken for illustrative purposes and can be produced by a four impeller uncooled centrifugal air compressor. With 14.6 psia and 100°F. inlet the 2.8 ratio is equivalent to 40.9 psia discharge pressure.

The adiabatic representation is useful in that it enables us to visualize what would take place in a frictionless or 100% hydraulic efficiency compressor. The adiabatic head may be visualized as a perfectly insulated column or mine shaft extending from the earth's surface, at an eleva-

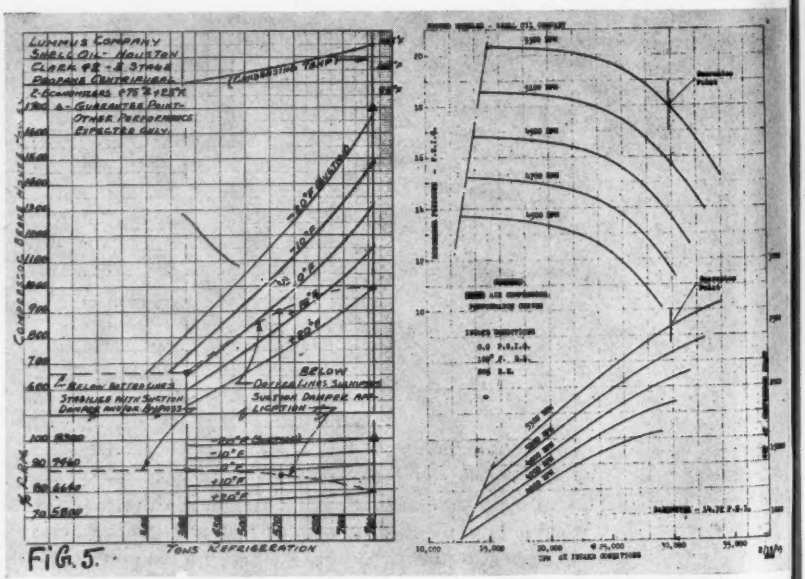

FIG. 5.

"CBV" COMBINATION BALANCED VALVES

For Precision in Gas Regulation!

The right gas pressure with continuous control is a prime need supplied by the "CBV" type regulators. These are combination balanced valves built in two interchangeable styles—either offset connected or direct connected.

The offset model allows easy access to inner valve assembly through a hand hole plate. It does not require removal of the entire superstructure to examine or change the valve assembly. In changing from a high to a low pressure regulator, the diaphragm chamber unit is replaced and the rocker arm shaft is changed to a low pressure rocker arm shaft. The offset connected style has a fulcrum between the diaphragm and valve assemblies.

In the direct connected regulator, the diaphragm assembly is connected straight through to the valve assembly. It comes in three optional types: the high pressure weight-loaded; spring-loaded; or pilot-loaded. This model also has interchangeable parts which permit switching to a spring or pilot-loaded assembly. The change is made by replacing the pressure lever cap with the spring housing unit or with the pilot cap. These quick and easy changes help to meet new needs and specifications.

Both offset and direct connected models are offered in high pressure weight-loaded, spring-loaded, or pilot-loaded types. Low pressure models are pilot-loaded or weight-loaded, either inside or outside weights being available. Semi-low pressure regulators are made in pilot-loaded or outside weight-loaded types. The low pressure and semi-low pressure regulators are offered only in the offset style. A 3.4 to 1 ratio is maintained to provide better lock-up under low pressures.

Valve body castings are the same for either high pressure or low pressure types. A free flow of gas is provided at the point of expansion and body friction is reduced to a minimum. Directional flow arrows are cast into both sides of valve body castings for the user's convenience.

The illustration below shows an American Metric Iron Case Meter and combination Reliance Balanced Valve Regulator, "CBV" model 201, which controls the gas pressure in many modern industrial plants.

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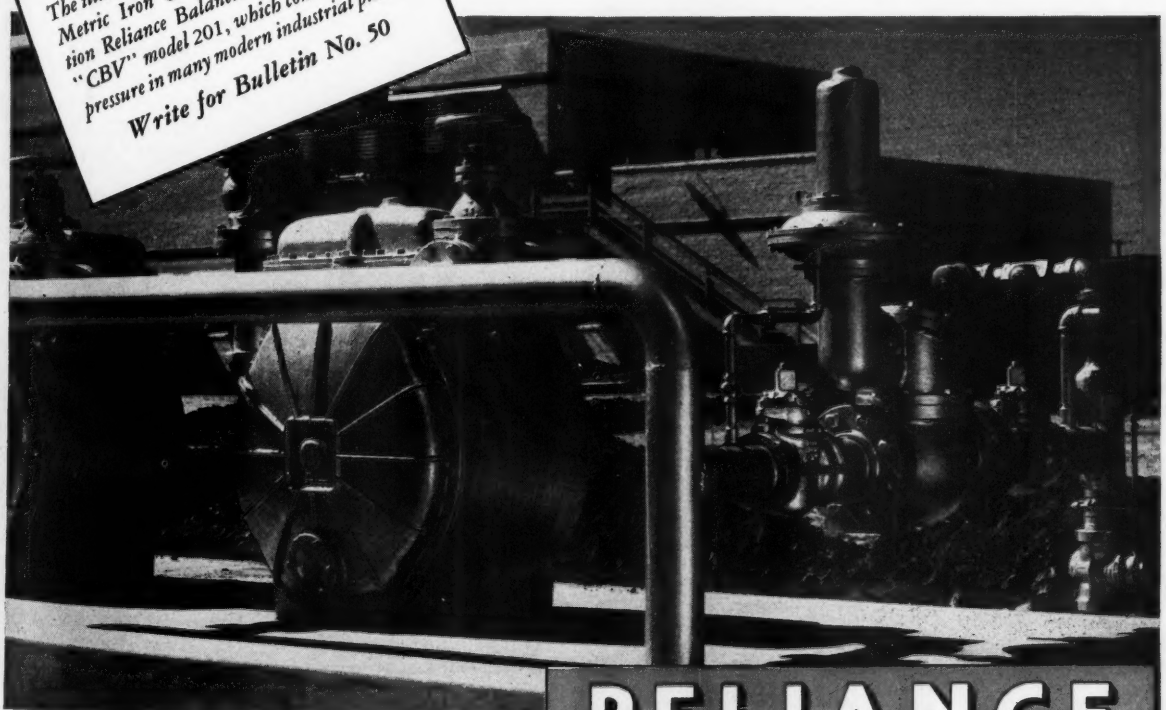


American Meters

RELIANCE REGULATORS

RELIANCE REGULATOR CORPORATION
1000 MERIDIAN AVENUE ALHAMBRA CALIFORNIA

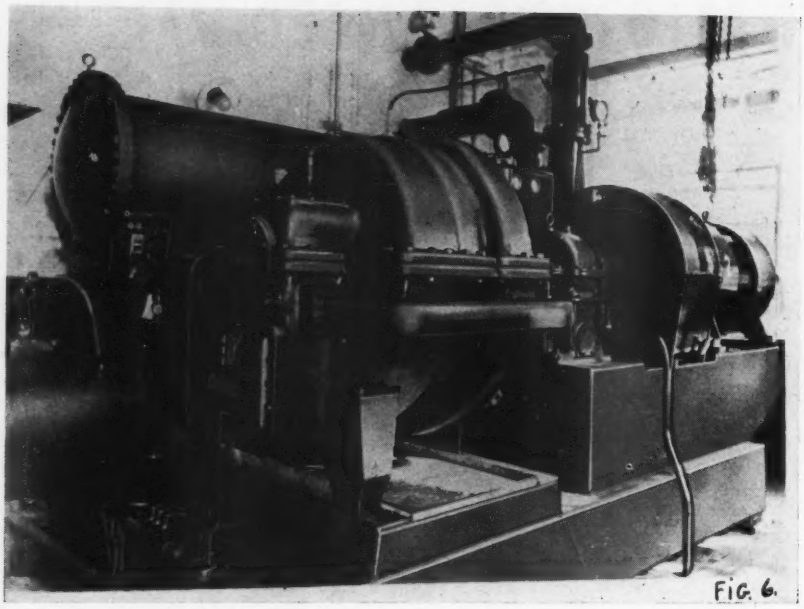


Fig. 6.

tion equivalent to 14.6 psia and 100° F., to a point 37,200 feet below where the pressure due to adiabatic compression would be 40.9 psia with the corresponding adiabatic temperature of 298°F. The weight of the air in a column of the height, temperature and pressure represented would be sufficient to produce the 24.3 lbs. per square inch gauge pressure differential and the temperature and pressure at quarter point elevations would be equivalent to the inlet conditions at the eye of the second, third, and fourth impellers. Adiabatic head (Fig. 13) is obtained from the familiar work formula in which volume VI is taken for one pound which results in a product of feet rather than foot pounds. In the past, most blower applications dealt with air and gases of like specific heat ratios, thereby permitting the use of the psuedo-adiabatic base with uncooled compressors. The adiabatic formulae illustrated are in general use for such applications. (Fig. 14) With the establishment of the overall head and its quartered division the pressures and temperatures are obtained by solving for pressure ratios equivalent to the proportionate heads. The formula has merely been rearranged for convenience.

Frictionless or adiabatic compression is a purely theoretical concept in an uncooled centrifugal compressor. It is necessary to bridge the gap between the theoretical concept and the polytropic process that takes place in the compressor. The term polytropic means "all heat" and is used for processes other than isothermal and adiabatic, whether temperatures and volumes lie between those of isothermal and adiabatic compression or above adiabatic as indicated in our uncooled compressor illustration. Using hydraulic efficiency that the manufacturer obtains from test and using available ratio of specific heat valves the polytropic exponent may be obtained from the relationship

$$\frac{N-1}{N} = \frac{K-1}{K} / \text{Eff.}$$

The value obtained is based on no radiation loss or gain. For gases of negligible compressibility, the familiar head formula is used in conjunction with the exponent thus obtained. With relatively high molecular weight hydrocarbons at high pressures, the use of the less familiar equation is recommended as it more accurately reflects compressibility. Use of the speed formula and an average value of .55 for "u" will allow estimating selections to be made with the Clark line. It should be noted that the head per impeller expression derives from the familiar gravity relationship, velocity squared equols 2gh. (Fig. 16) The manufacturer's application engineer makes more accurate selections by selecting "u" values from his nominal rating table and the applicable pressure and effciency corrective factors.

Use of applicable formulae in conjunction with the polytropic exponent of compression (return to Fig. 12) gives us the head temperature and pressure relationships for polytropic compression. The losses within the compressor result in temperatures higher than corresponding adiabatic temperatures. The higher temperatures lower the specific weight of the gas and we must

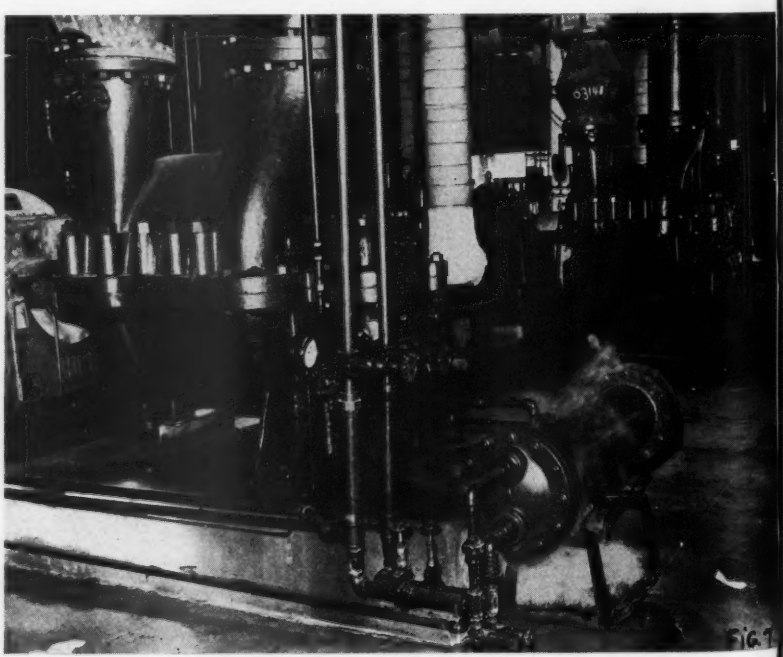
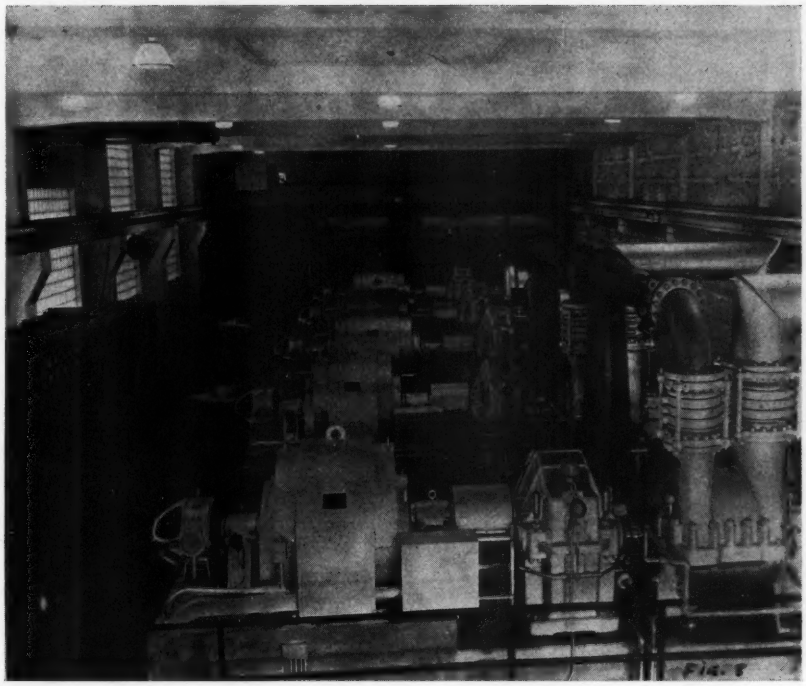


Fig. 7

consequently have a greater number of feet of the lighter gas to be equivalent to a pressure differential of 24.3 lbs. per square inch. Approximately 5% more head is required because of this higher temperature. The discharge temperature of 361°F is the temperature that would be read on a thermometer if the machine were under test. Our calculation assumed our knowing the hydraulic efficiency and no radiation loss or gain from the compressor.

While the liquid pump operates with equal pressure rise, constant volume, and approximately constant temperature through each impeller, the uncooled gas pump operates with variable pressure rise, volume and temperature. The gas pump impellers may be selected for equal diameter but the width of the impellers is decreased as we progress through the machine. The multistage liquid pump may employ identical impellers throughout.



With constant inlet temperature and volume the gas pump would compress from 146 psia to 409 psia or a differential of 263 lbs. per square inch. It is apparent that the compression ratio has remained constant with the increased inlet pressure and horsepower has increased in the approximate ratio of 10 to 1. The liquid pump would continue to deliver 800 lbs. per square inch differential with increased suction pressure and horsepower would remain substantially the same. Neglecting viscosity, both the centrifugal gas pump and liquid pump are independent of density as regards head. The centrifugal gas pump will develop the same head whether handling hydrogen or mercury vapor. (Fig. 15). The pressure ratios for a given head or number of impellers vary markedly however. It will be noted that a 5 impeller compressor will produce a pressure ratio of approximately 2 to 1 when compressing methane, while the same number of impellers (or head) will produce approximately 12 to 1 when compressing butane.

The 700 feet per second peripheral speed given in the tabulation is quite conservative. Tip speeds of magnitude of 750 to 775 feet per second will be more normal. These tip speeds are 4 to 5 times those employed for liquid pumps and consequently result in a much more rugged machine as the gas pump is designed for the higher stresses involved.

We have covered head as related to water pumps, and uncooled centrifugal air compressors for both the psuedo-adiabatic and actual polytropic base.

Iso-thermal compression and gases, other than air (Fig. 11), should be considered in order to round out the picture. Iso-thermal implies compression without temperature rise. With an infinite amount of inter-cooling, we may approach but not reach iso-thermal compression. Some European manufacturers design their centrifugal air compressors for a high degree of intercooling between impellers as power cost is, generally speaking, of greater economic significance there than is the case in the United States. The degree of cooling achieved is such that air compres-

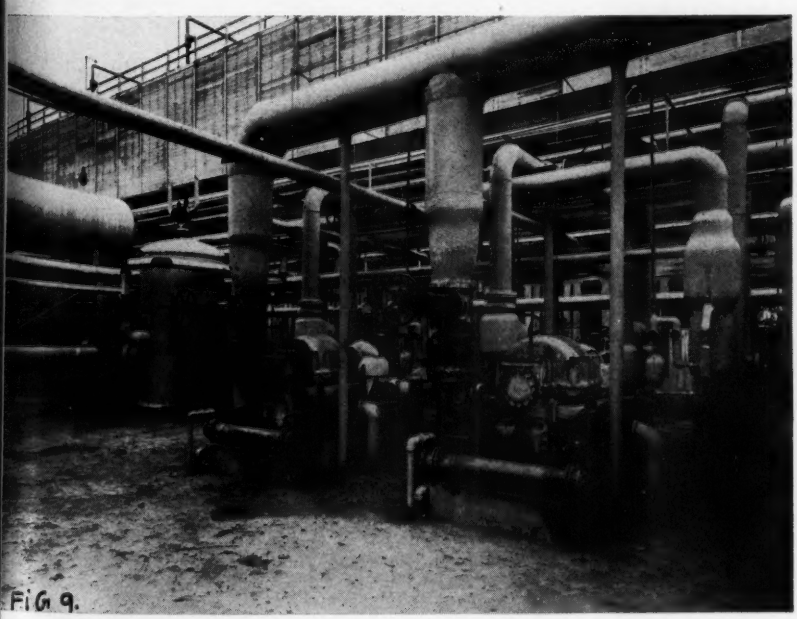


FIG 9.

The safest elevators in the world are also the easiest to work

BJ

AA and MAA Center Latch

ELEVATORS

for the longest strings of collar type pipe

Type AA and MAA Elevators are designed to handle the heaviest, longest strings with maximum safety and minimum effort.

RATINGS—Type AA has a rated capacity of 300 tons for all sizes of drill pipe. Type MAA has a rated capacity of 200 tons for 4½" pipe. Both are designed with a safety factor of 4 to 1, in accordance with proposed API standards.

BALANCE—When opened, these elevators *stay* open in a balanced position. Type AA, being larger, has a cam and roller spreading device that holds it open. The elevator arrives at the fourble board in operating position . . . ready for instant closing around the pipe.

LONG HORNS (or operating handles) protect the operator's hands by keeping them away from links and elevator body.

LATCH LOCK engages positively and instantly and prevents accidental opening. Once closed, the latch can be opened only by deliberate unlatching of both latch lock and latch. The latch is designed to eliminate stress on the latch pin, and it is recessed and guarded to prevent contact with links even when "tailing in" or "laying down."

FLAME HARDENING of top bearing surface, coupled with proper heat treatment of selected pre-magna fluxed alloy steels, assures long life under the terrific pounding of hardened tool joints.

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sion temperature and volume fall between iso-thermal and adiabatic. As use of either process results in the selection of a psuedo-base, isothermal is apparently chosen for simplicity of calculations.

It will be noted that with equal pressure ratios the deviations from adiabatic for uncooled centrifugals are by no means constant. We have a 5% variation with air, a 4% variation with sulfur-dioxide and a 2.1% variation with propane. The gravity of the gas does not explain this variation as sulfur-dioxide with the higher gravity has a greater variation than propane. The ratio of specific heats seems to have the most marked effect. The second column for propane shows the effect on head when compressibility is figured for the compressor discharge condition. The inlet and outlet pressures used in the calculations are in the range of commercial applications.

The efficiency variations are given in points of efficiency. Three and a half points for air, two and eight-tenths for sulfur-dioxide and one and six-tenths for propane. It is apparent that the use of efficiencies related to the adiabatic base would result in a discrepancy of one and eight-tenths percent for propane. In other words, our adiabatic efficiency for propane would be 70.6% instead of 72.4%.

It would appear that the great variety of gases, with varying specific heat ratios and compressibility characteristics, that could conceivably be compressed centrifugally will require some special consideration if inaccuracies in horsepower and speed calculations are to be avoided.

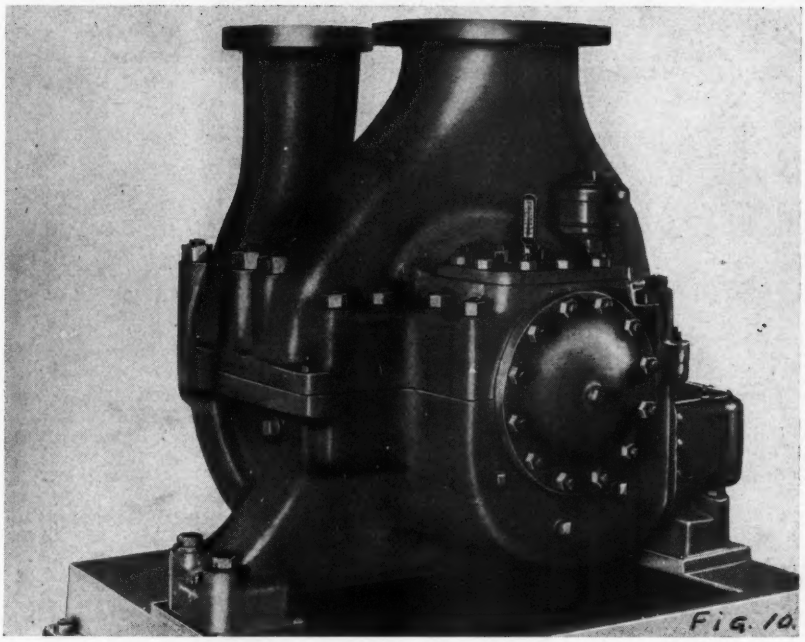


Fig. 10.

It is recognized that the use of an adiabatic base and of Mollier diagrams permits rapid calculations of compression horsepower requirements, and is favored by engineers in the industry. With reciprocating compressors the variation between the psuedo-adiabatic base and the actual is small with water-jacketed cylinders, and adiabatic therefore provides the required accuracy. Uncooled centrifugals cannot be selected with accuracy on an adiabatic basis if gases of widely divergent specific heat ratios are to be accommodated from the same rating data. Practically all the losses in a centrifugal tend to heat the gas and accentuate the variations. Mechanical losses are the only external losses and seldom exceed 1%.

As we pointed out for European air compression practice, any base will give a certain degree of accuracy if the gases to be handled are of like specific heat ratio and compressibility is also a negligible factor.

Personal experience with the use of the actual polytropic concept and hydraulic efficiency as used by hyraulic turbine and pump designers does not render us unmindful of the point that an adiabatic air or equivalent base could be used and corrective factors employed for the gases that deviate excessively from air. It has been felt that the use of such factors will prove more cumbersome, in the future, than solving for the polytropic exponent.

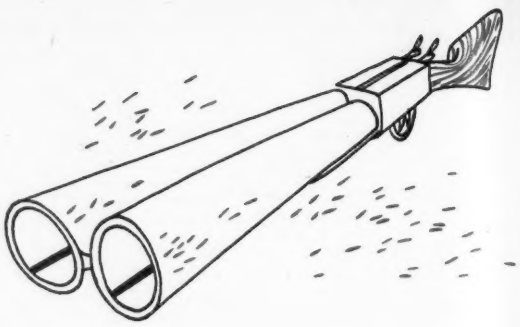
When working with the actual head, one set of rating curves will suffice (Fig. 31) if the application engineer will avoid exceeding sonic speed with the gas to be compressed. The critical condition exists at the impeller inlet and results in the phenomenon sometimes referred to as the stonewall. Note that the

DEVIATION FROM ADIABATIC UNCOOLED CENTRIFUGAL COMPRESSORS

	AIR		SO_2		PROPANE		PROPANE
Relative Gravity	1.0		2.215		1.52		1.52
Compression Ratio	2.8		2.8		2.8		2.8
CFM at Inlet	26,000		6150		5830		5830
Inlet, p.s.i.a.	14.6	26.3	40.3	72.7	89.3	160.7	89.3	160.7
Discharge, p.s.i.a.	40.9		113.0		250.00		250.00	
Inlet Temperature, °F.	100	261	60	144	48	99	48	97
Discharge Temperature, °F.	361		204		147		145	
Specific Volume Cu./Ft. # Inlet	14.82		2.05		1.165		1.165	
Specific Volume Cu./Ft. # Outlet							.46	
Polytropic "N"	1.593		1.38		1.21		1.203	
Adiabatic "K"	1.395		1.256		1.15			
Isothermal "K"	1.0		1.0		1.0			
Polytropic Head, Ft.	39,050	5.0%	14,180	4.0%	16,880	2.1%	16,300	
Adiabatic Head, Ft.	37,200		13,630		16,520			
Isothermal Head, Ft.	32,100		12,280		15,410			
Polytropic Efficiency (Base)	76.0	3.5%	74.0	2.8%	74.0	1.6%	74.0	
Adiabatic Efficiency	72.5		71.2		72.4			
Isothermal Efficiency	62.5		64.0		67.5			
Hydraulic Horsepower	2800		1742		3460		3340	
Weight Flow #/Minute	1800		3000		5000		5000	

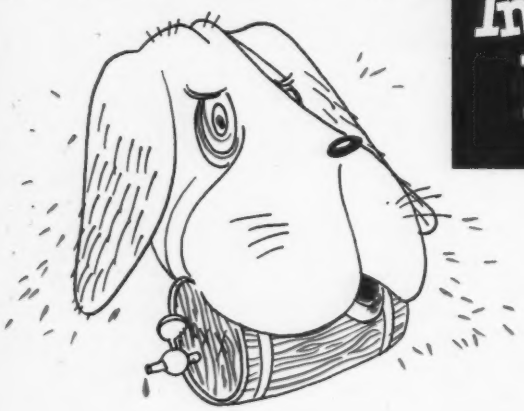
Fig. 11.

Illustrated above is just a simple "barrel-for-going-home-in" — very useful after friendly poker parties . . .

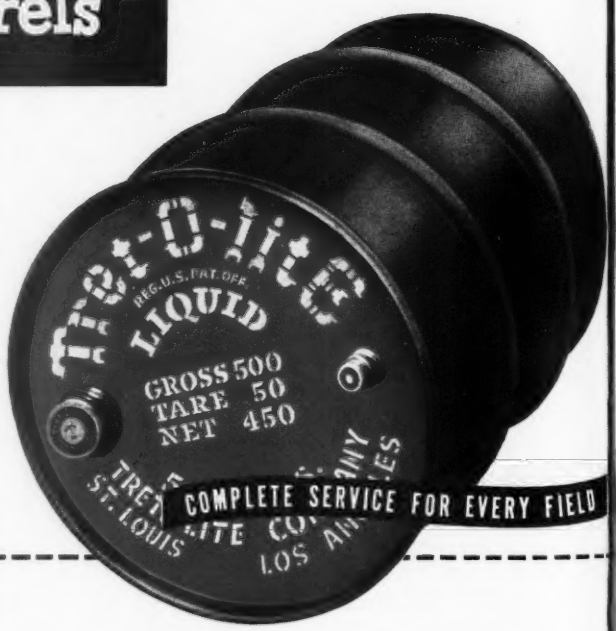


This version is known as the "double-barrel." Frequently used for small game and matrimonial persuasion . . .

Interesting Barrels



These small barrels, or casks, carried by St. Bernard dogs in the Swiss Alps, usually contain brandy—giving further proof to the belief that "dog is man's best friend" . . .



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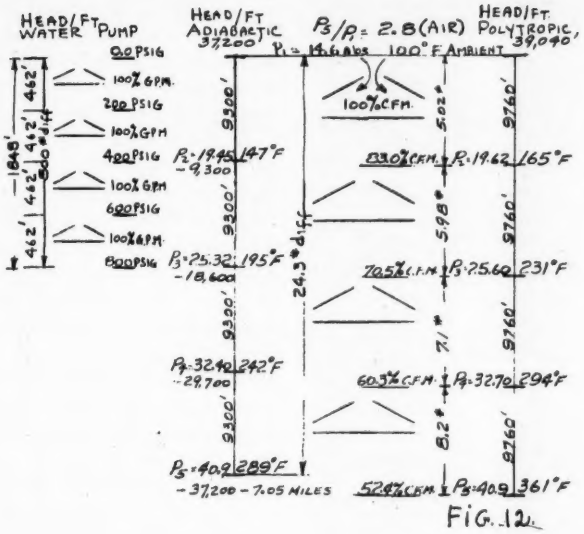


FIG. 12.

head versus first impeller inlet cfm. The constant speed curves are plotted in percent of nominal RPM. As the speed and head is increased, the surge point moves over toward the stonewall thereby decreasing the stable range of operation. With air and low molecular weight gases we do not normally encounter this sonic speed phenomenon and the head curves carry out in a manner similar to the 95% nominal speed and below curves with a resultant wider range of stable operation.

We previously spoke of the dissimilarity of the centrifugal machine operating characteristic when compared with the reciprocating compressor. The dis-similarity is such that one type's strength becomes the other's weakness. The strength of the centrifugal lies in its ability to handle wide capacity variations with slight head variations. The illustration (Fig. 31) shows a 42% capacity decrease with 23% increase in head at 100% nominal speed. The 23% increase is excessive for petroleum hydrocarbon compressors that have less backward blade curvature and do not crowd the stonewall. Percentage-wise, the increase in head is also on the high side for high compression ratios that obtain on low temperature refrigeration applications and natural gas compression requirements that could conceivably involve compression ratios as high as 20 to 1. A recent check on a problem of this nature revealed that with approximately 14 lbs. absolute inlet pressure and 300 lbs. absolute discharge pressure, an increase in suction pressure of five pounds would sequire an average speed reduction of approximately 6% with discharge pressure and weight flow remaining constant.

From the illustration it will be observed that 9.3% speed reduction will reduce the volume from 3100 cfm. to 1370 cfm., with a constant head of 7000 ft., before reaching the surge point. This is a volume or weight flow reduction of 55.8% with only 9.3% speed reduction. If stability is the prime consideration, the compressor could be operated at constant speed and the 23% increase in head could be employed in suction throttling which would increase the vapor volume at the compressor inlet which, in turn, moves the operating point to the right and provides stability with even lower weight flow than the 44.2% obtainable with speed reduction.

Engineers are familiar with the laws that apply to centrifugal fans, pumps, and compressors, viz—volume varies as the first power of speed, head as the square of speed and horsepower as the cube of speed.

It is sometimes erroneously assumed that if speed and volume changes as the first power, the head must change as the square of the speed and the horsepower must vary as the cube of the speed change. This approach overlooks the system characteristics that the centrifugal machine has to contend with. In a system where head is composed entirely of frictional resistance, and since pressure drop varies approximately as the square of volume or velocity, this approach is not far off. Most systems, however, are composed of fixed pressure differences that are of far greater magnitude than the frictional head. Large differences in flow in such systems

For normal air and perfect diatomic gases the following formulas are in general usage:

$$\frac{c_p}{c_v} = 1.3947 = \gamma \qquad \frac{\gamma-1}{\gamma} = \frac{.3947}{1.3947} = .283$$

$$R = \frac{1544}{28.91} = 53.34$$

$$x = \left(\frac{p_2}{p_1}\right)^{.283} - 1$$

Values of X have been tabulated by Moss and Smith for normal air and perfect diatomic gases.

From Effective pressure ratio:

$$\eta_p = \frac{1}{.283}(x) \quad \text{or} \quad \eta_p = \frac{x}{\frac{\gamma-1}{\gamma}\left[\left(\frac{p_2}{p_1}\right)^{\frac{\gamma-1}{\gamma}} - 1\right]}$$

Adiabatic Head $= \frac{1}{.283} 144\, p_1 v_1 \left[\left(\frac{p_2}{p_1}\right)^{.283} - 1\right]$ or

$$\text{Head} = 144\, p_1 v_1 \times \eta_p$$

$$\text{Adiabatic HP} = \frac{1}{.283} \times \frac{144}{33000} \times \frac{CFM \times p_1 \times x}{EFF.} = \frac{.01142 \times CFM \times p_1 \times x}{EFF.}$$

$$HP = \frac{\text{Wt. Flow \#/Min.} \times \text{Head}}{33000 \times EFF.}$$

$$= (\#\,\text{Min.} \times v_1) \times \left(\frac{144}{33000}\right) \times \frac{p_1 \times \eta_p}{EFF.}$$

$$= \frac{CFM \times p_1 \times \eta_p}{.234 \times EFF.}$$

$$\eta_p = \frac{(U_2)^2 \times \text{No Impellers} \times \text{Pressure Coefficient}}{(32.2 \times 53.34) \times T}$$

$$U_2 = \sqrt{\frac{\eta_p \times 1716 \times T}{\text{Pressure Coefficient} \times \text{No Impellers} \times \text{relative gravity}}}$$

$$U_2 = \frac{\pi D N}{720} \qquad N = \frac{720 \times U_2}{\pi D}$$

U_2 = Peripheral Speed in Ft. per Second
N = Revolutions per Minute
D = Diameter of Impeller in Inches

FIG 13.

ADIABATIC FORMULAE (CONTINUED)

$$\left(\frac{p_2}{p_1}\right)^{.283} = \frac{.283 \times \text{Adiabatic Head}}{144\, p_1 v_1} + 1$$

$$v_2 = v_1 \left(\frac{p_2}{p_1}\right)^{.283}$$

POLYTROPIC FORMULAE

Polytropic exponent $= \frac{n-1}{n}$ (uncooled)

$\frac{n-1}{n} = \frac{n-1}{n}$ / Hydraulic Efficiency $\frac{n-1}{n} = .283$

$= .283 / .76 = .372$

Polytropic Head $= \frac{1}{.372} 144\, p_1 v_1 \left[\left(\frac{p_2}{p_1}\right)^{\frac{n-1}{n}} - 1\right]$

$$\left(\frac{p_2}{p_1}\right)^{\frac{n-1}{n}} = \frac{\frac{n-1}{n} \times \text{Polytropic Head}}{144\, p_1 v_1} + 1$$

$$v_2 = v_1 \left(\frac{p_2}{p_1}\right)^{\frac{n-1}{n}}$$

From the relationship $(U_2)^2 = 2gh$

$$\text{Head/Impeller} = \frac{\text{Pressure Coefficient} \times (U_2)^2}{32.2}$$

$$N = \frac{1320}{D}\sqrt{\frac{\text{Head/Impeller}}{}}$$

Isothermal Head $= 144\, p_1 v_1 \times 2.302 \log_{10} R$

Polytropic Head $= \frac{144 \times 2.302}{n-1}\left[p_1 v_1 \times p_2 v_2\right] \log_{10} R$

$= 328.9 \left[p_1 v_1 \times p_2 v_2\right] \log_{10} R$

U_2 = Impeller peripheral speed in Ft. per second
N = Revolutions per minute
D = Diameter Impeller in inches
η_p = Pressure coefficient product of centrifugal action in impeller and conversion of velocity pressure to static pressure in diffusor. Varies with blade angle and other factors between .5 to .8
R = Ratio of compression $\frac{p_2}{p_1}$

FIG. 14.

CENTRIFUGAL COMPRESSORS

COMPRESSION RATIOS*

(14.7 PSIA, 100°F. ENTR. COND.)

NO.	GAS	MOL. WT.	2 IMPELLERS P_2/P_1	3 IMPELLERS P_2/P_1	4 IMPELLERS P_2/P_1	5 IMPELLERS P_2/P_1
1	Air	29	Max. 1.70 Min. 1.62	Max. 2.13 Min. 2.01	Max. 2.64 Min. 2.45	Max. 3.19 Min. 2.94
2	Methane CH_4	16	Max. 1.36 Min. 1.33	Max. 1.57 Min. 1.51	Max. 1.80 Min. 1.72	Max. 2.05 Min. 1.94
3	Natural Gas	20	Max. 1.46 Min. 1.42	Max. 1.75 Min. 1.67	Max. 2.13 Min. 1.95	Max. 2.43 Min. 2.26
4	Ethylene C_2H_4	28	Max. 1.69 Min. 1.62	Max. 2.15 Min. 2.03	Max. 2.70 Min. 2.50	Max. 3.34 Min. 3.06
5	Ethane C_2H_6	30	Max 1.76 Min. 1.68	Max. 2.26 Min. 2.12	Max. 2.88 Min. 2.65	Max. 3.6 Min. 3.28
6	Propylene C_3H_6	42	Max. 2.19 Min. 2.06	Max. 3.12 Min. 2.85	Max. 4.35 Min. 3.89	Max. 5.95 Min. 5.23
7	Propene C_3H_8	44	Max. 2.27 Min. 2.13	Max. 3.28 Min. 2.97	Max. 4.63 Min. 4.13	Max. 6.40 Min. 5.58
8	N-Butane C_4H_{10}	58	Max. 2.96 Min. 2.72	Max. 4.82 Min. 4.25	Max. 7.65 Min. 6.52	Max. 11.80 Min. 9.80
9	Iso-Butane C_4H_{10}	58	Max. 2.96 Min. 2.72	Max. 4.82 Min. 4.25	Max. 7.65 Min. 6.52	Max. 11.80 Min. 9.80

* "U" value at Max. = .57
"U" value at Min. = .52
Impeller Tip Speed = 700 ft./sec.

FIG. 15.

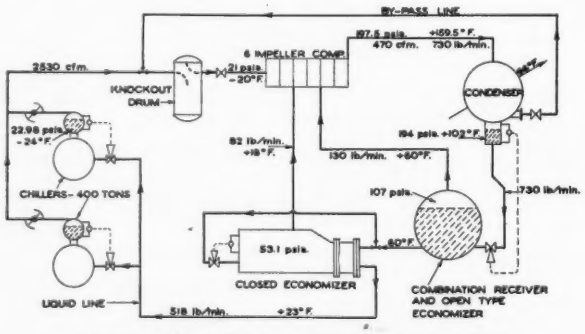
curves are plotted for polytropic do not appreciably affect the overall head. It will be recognized that the centrifugal compressor characteristic matches a system characteristic of this type, i. e., large flow variations with slight change in head.

Depending upon the system characteristic, the centrifugal may be automatically made to operate at any point to the right of the surge line on any of the speed curves if provided with variable speed. It is a simple matter to provide such control with turbines. With constant speed motor drive it is a question of economics as to whether the incremental cost of hydraulic couplings or magnetic couplings will pay out over simpler suction throttling. It is apparent that such devices operate at optimum efficiency when coupled with the centrifugal characteristic which keeps coupling losses to a minimum because of the slight speed reduction required for large capacity variations. With constant speed the compressor will operate at any volume to the right of the surge point on the 100% nominal speed curve or any other single curve for that matter. Further stability is obtainable by means of suction throttling as previously mentioned.

It is apparent that machines with such a relatively flat head characteristic are sensitive to head variations. It is for this reason that the centrifugal application engineer thinks in terms of head and carefully selects the rotative speed that will produce the required head. The reciprocating application engineer, on the other hand, gives due consideration to volumetric efficiency which is relatively unimportant in centrifugal selections. The reciprocating machine may be said to have a relatively flat volume characteristic at a given speed as its head varies over a wide range with slight changes in volume. The reciprocating compressor is sensitive to volume and is often furnished with clearance pockets or speed variation. The entrifugal is sensitive to speed and is more often furnished with variable speed and suction dampering that with bypass.

It is important that a centrifugal machine and its driver be selected for a speed that will permit the compressor to deliver the required pressure differential with the minimum gravity gas the machine will be called upon to handle. If this precaution is taken (Fig. 4) there need be no fear of the machines coping with variable head or pressure conditions. The operating charts were taken concurrently and illustrate the capacity surges that can be handled by a centrifugal machine while maintaining close control of temperatures or pressures in process. Note that the load on the driver varies in the ratio of 80 to 20 or 4 to 1 as indicated by steam flow. These fluctuations in load are accompanied by rapid changes in head to which the machine responds almost instantaneously through the medium of a relatively simple control device.

Still wider ranges of head and pressure are met on certain intermittent duties such as skating rinks. Machines are called upon to start



TYPICAL FLOW DIAGRAM FOR 400 TON PROPANE CENTRIFUGAL REFRIGERATION CYCLE

FOR 800 TON DUTY THE WEIGHT FLOWS CAN BE TAKEN AS TWICE THOSE GIVEN ABOVE. DISCHARGE TEMPERATURE WILL BE SOMEWHAT LOWER.

FIG. 18.

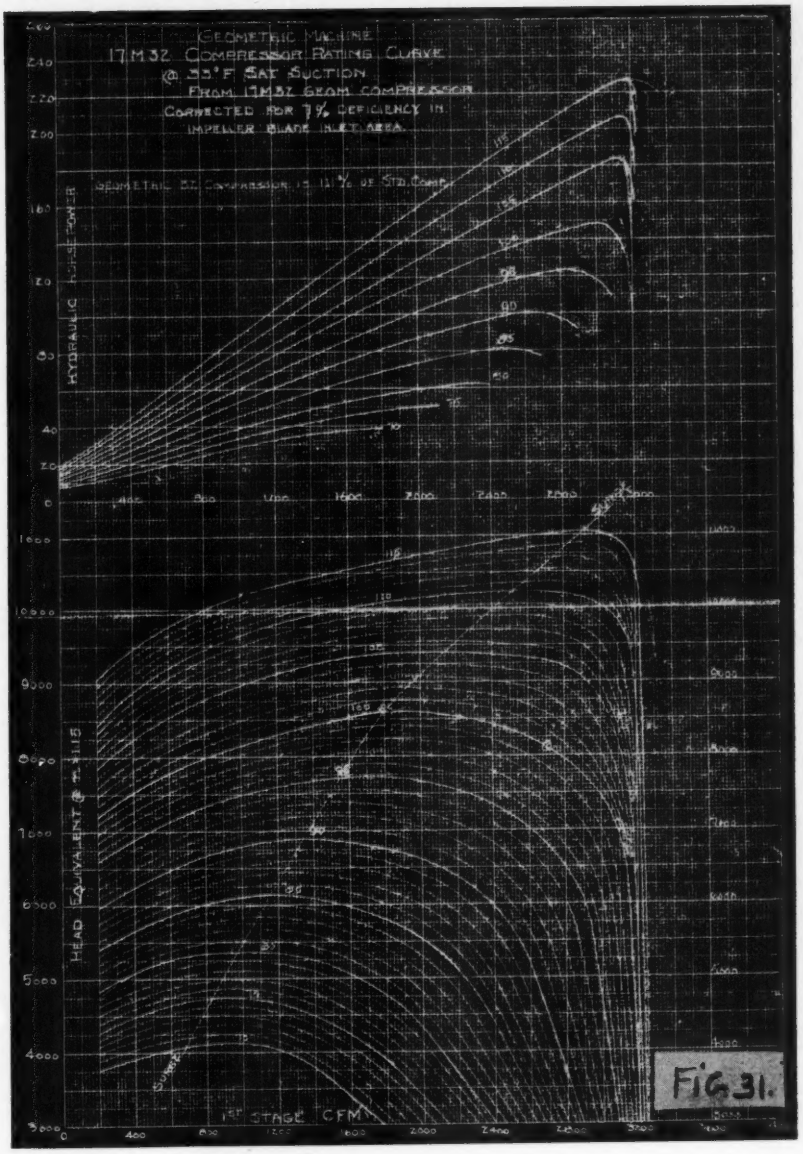
chilling the brine tank at a relatively high temperature level of 55°F and pull down to 25°F. As indicated by curve "A", the final brine temperature is approximately 10°F, giving a range of 45°F. This is a duty that imposes a hardship on the centrifugal compressor and reciprocating type compressors are unquestionably better adapted if the operation is continuous. Two other well known stadiums, Madison Square Garden and Atlantic City Convention Hall, have likewise employed centrifugals for this duty for over fifteen years. The N.A.C.A. wind tunnel in Cleveland employs 21,000 horsepower of centrifugals over an even wider range of temperatures and pressures.

While continuous duty and high power costs would undoubtedly favor reciprocating equipment for such duties, it is of interest to note that centrifugals can be adapted to such an unfavorable duty and that Madison Square Garden has purchased centrifugals again after approximately 20 years operating experience with such an arrangement. (Fig. 5)

Performance curves for machines that take suction at constant pressure normally plot cfm. at constant inlet condition against discharge pressure. Corrective factors for varying inlet temperatures must be employed. The curve on the right is illustrative of such performance curves.

The operating characteristics of a centrifugal compressor on a refrigeration cycle can be best represented by plotting varying suction temperatures against horsepower and capacity as shown in the upper half of the curve at the left, and varying suction temperatures against % RPM and capacity as shown below. Note that at 100% capacity approximately 21% speed reduction is required to raise the suction temperature from -20°F. to plus 20°F. or a range of 40°F. At 50% capacity only 12% speed reduction supplemented by suction throttling is employed in order to avoid surging. (Fig. 32)

In addition to head and discharge pressure, pressure ratio may be plotted against inlet cfm at a given inlet temperature. Performance curves of this type may prove to



be of more use to the customer on gas compression applications, if the suction pressure were subjected to variations. Note that the pressure ratio is 2.55 when handling 9000 cfm. The surge point is at 4100 cfm volume or 45.5%. The 54.5% increase in volume from surge point to 9000 cfm is accompanied by a reduction in pressure ratio from 2.93 to 2.55, or 13%, while the corresponding head reduction is equivalent to 15%. This value corresponds to the previous 23% increase in head given for the compressor with impeller blades of more backward curvature. When the 23% factor is adjusted for equal stability range and head reduction rather than increase, the value becomes 24% as compared to 15%. This is to be expected as greater backward curvature of impeller blades results in a more drooping characteristic curve.

Note that while the compressor shows a maximum hydraulic efficiency of 84%, the efficiency at the selection point is 76%. This is another inherent difference in centrifugal and reciprocating compressors. For reasons of stability and oftimes maximum efficiency at normal operating condition, the centrifugal is not picked at its most efficient point. This results in relatively higher full load power for the centrifugal than for a recipro-

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cating installation. While the reciprocating compressor shows to best advantage by comparing at full load and maximum pressure ratio, the centrifugal gains efficiency at part load, within the range of stable operation, while the fixed valve losses and higher mechanical losses in the reciprocating machine result in a falling off in efficiency at part load. The centrifugal machine has no valves and its mechanical losses are insignificant.

The pulsation or surge point is covered on pages 46 and 47 of the text by Austin H. Church and will not be repeated at this time. It is pertinent to observe that head imparted to the fluid is largely pressure head due to centrifugal force and partly velocity head. This velocity head falls off with decrease in flow until a point is reached where the fluid flows back through the machine and pressures drop to the zero flow valve. The point at or near the peak of the pressure curve, where reversal occurs, is termed the surge point. This is a characteristic of centrifugal liquid pumps as well as centrifugal gas pumps.

Means of providing a wider range of stable operation before reaching this point are resorted to by centrifugal compressor engineers.

Speed reduction will provide a small measure of added stability as the pulsation point drops back as the first power of speed reduction as indicated by the slope of the indicate surge point. (Fig. 18)

Commercial approaches to providing a wider range of stable operation have resulted in the use of suction throttling and bypassing from discharge to suction or intermediate stages. You will note that the flow diagram indicates both a valve at the compressor suction that could be either manually or automatically operated and a bypass valve that could be either manually or automatically operated.

The term "commercial" was chosen because there are other methods that could be used such as a power recovery device through which by-passed air or gas would be reduced from compressor discharge to compressor suction pressure and the recovered power used to unload the main driver.

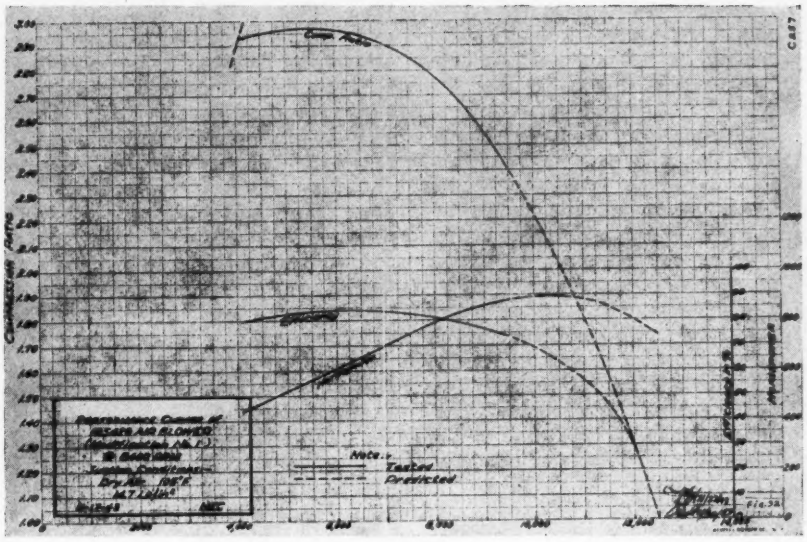


Fig. 32

Another method that is applicable to high volume low pressure machines handling clean fluids are adjustable diffuser vanes. This method has provided a very high degree of flexibility on high volume machines for special testing purposes. Most applications of this type have been made by European firms.

Another method—adjustable inlet guide vanes—is illustrated by the photo of Clark fixed inlet guide vanes which provide approximately 15% fixed volume variation by the alternate use of radial or against rotation vanes. As will be gathered from the above percentage of 15%, the method is limited in range even though arranged for automatic operation. On multi-stage units of small physical size, the method is generally confined to the first impeller which reduces its utility.

The small extent of utilization of the above three methods in the United States is possibly due to our relatively low power cost.

On high pressure machines the physical size of the equipment is not conducive to incorporation of cumbersome movable vanes and mechanisms. The fear of fouling due to foreign matter in the gas may also be a deterrent.

At the present time the economic use of centrifugals is limited to relatively high capacities, as covered hereinbefore, where steam or electrical drive fits economically.

Generally speaking, the economies of the driver, in the petroleum industry, is considered to be of greater significance than the compressor. Therefore, when burning of fuel gas direct offers the most economical power, it would appear that the centrifugal compressor will continue in a disadvantageous competitive position for some time to come.

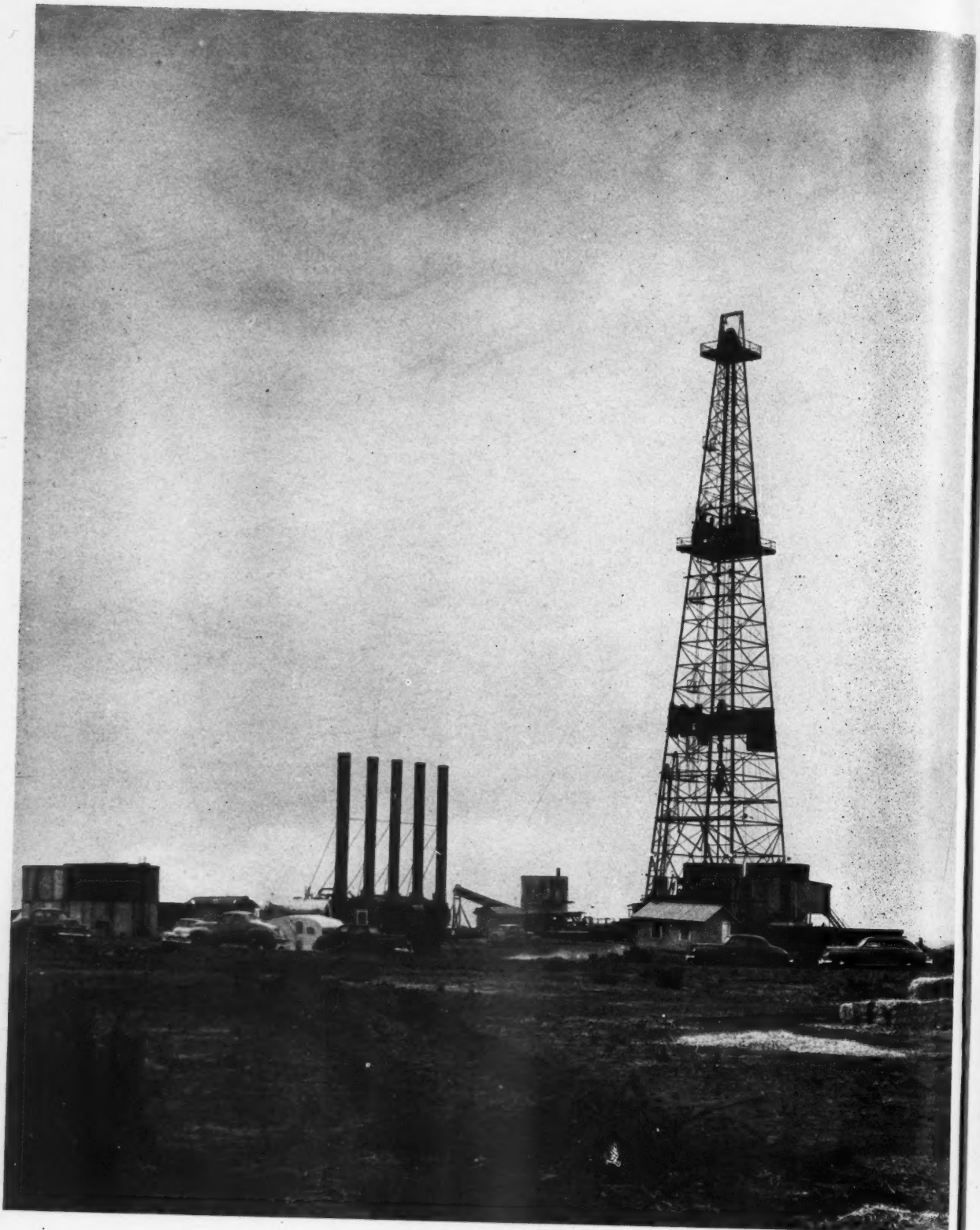
Gas turbines, or other commercial means of providing the centrifugal with a driver that might compete with the internal combustion gas engine, are being given consideration but appear to be in the development rather than the commercial stage.

Seaboard Plans Mission Wildcat

Seaboard Oil Co. plans another drilling job on its Mission Land lease in the Newhall area in Sec. 25-3n-16w, about 500 ft. southeast of No. 8-1, which is rigging to pump from 9528 ft.

Montebello Try Builds Foundation

Foundation has been constructed for Barnsdall Oil Co.'s Cipes No. 1, an exploratory venture in Sec. 7-2s-11w in the Montebello area, Los Angeles County.



The World's Deepest Well

World Depth Record Well Successfully Recovering Drill Pipe

More than three miles of drill pipe stuck in Pacific Western Oil Corp.'s world drilling-depth record well in the Miramonte area offered a problem of many complexities. The company, nevertheless, is making remedial progress and may solve the difficulties completely.

At this writing, approximately 11,500 ft. of drill pipe is coming out of the hole, after the string was cut and freed. A previous attempt was made to cut pipe at 14,450 ft. It apparently failed to separate or break loose at this point.

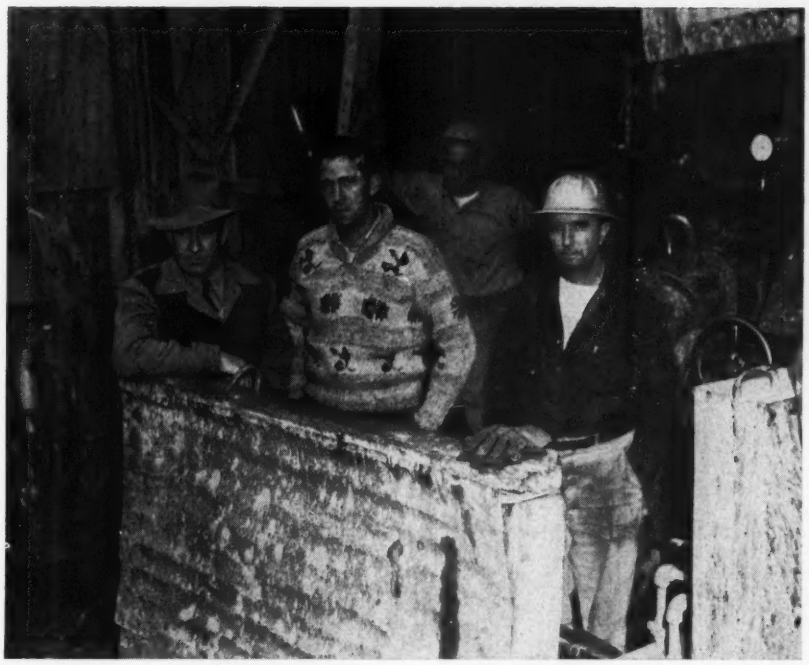
Contrary to reports, the company entertains at present no thought of giving up any portion of the hole. The next move will concentrate on efforts to recover pipe still remaining down deep. If successful, drilling operations will be resumed where they left off at a depth of 16,668 ft, or 13 ft. below the previous record for deep drilling held by Phillips Petroleum Co.'s wildcat test in Brazos County, Texas.

Circulation was maintained during the first few days pipe was stuck, and then lost.

In order to locate point at which pipe was stuck, the Magna-Tector was called into use. This electronic oil well tool is manufactured and operated exclusively by McCullough Tool Co. It embraces a ready faculty for determining the lowest point at which stuck pipe may be freed and also the depth at which recovery could best be made

Use of the Magna-Tector is implemented by running it in a well on regular McCullough electric conductor cable employed for gun-perforating. Electric current is turned into the line when the tool arrives at the level designated for testing. This energizes two specially contrived magnets at each end of the tool.

These energized magnets hold fast to pipe sidewall and act as anchors in keeping the whole assembly in a position fixed relative to pipe.



Pictured above, left to right: Harry Buchanan, Superintendent Loffland Brothers, Drilling Contractors; Ed Mohr, Baroid Engineer in Charge; Bob Parmon, Driller; Harvey Phillips, Derrick Man, in back.

Harry Buchanan, Loffland Brothers, Doug. Marcell, Pacific Western Oil Corp. Warren Craddock also with Pacific Western, and Watson Holder of Loffland Brothers.

There is a

REED ROCK BIT

AVAILABLE TO EFFICIENTLY DRILL SPECIFIC FORMATIONS

Reed Rock Bits are designed and constructed for maximum safety under the toughest drilling conditions.

The roller bearing mounted cutters are independently supported on drop-forged bit quadrants that are cross tied with the bridge. This construction provides maximum strength and safety for the drilling of any formation, especially the hard formations with heavy drilling weights on the bit.

The inherent characteristics of the Reed Cross Roller Cutter principle of design make for high drilling efficiency when only light drilling weights can be used.

✓ *Check these points for*

FASTER—STRAIGHTER—FULL GAUGE HOLE

REPLACEABLE SLUSH NOZZLES FOR CORRECT CLEANING ACTION

CUTTER TEETH AND GAUGE BEVELS FULLY PROTECTED

UNUSUALLY STRONG BEARING ASSEMBLIES

DROP FORGED BIT QUADRANTS UNIFIED FOR GREATER STRENGTH AND SAFETY

Reed **ROLLER BIT COMPANY**

HOUSTON 1, TEXAS, U. S. A.

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According to the McCullough Co., an upward pull on pipe, with enough stress or strain to cause stretching and flexing in the most minute degree, will move the magnets further apart by elongation.

It was explained that a stretch as little as .001 of an inch between magnets is transmitted by an extremely sensitive electronic device to the surface, where it is duly recorded on meter or gauge. The magnets are space five feet apart and the device finds its place near the center of the tool in combination with a telescopic joint.

A stretching of one inch per 100 ft. results in a consequent .050 of an inch elongation of pipe between the two magnets. Exemplifying the amazing response of the tool, this is more than 50 times the stretch necessary to adequately operate the transmitter and provide definite signs where pipe is free.

Nothing intricate is involved in resetting the tool for testing at different elevations. All that is necessary is to de-energize the magnets by switching off electric current at surface, move the tool to a new elevation and re-energize the magnets. As many settings or tests as desired can successfully be made, without coming out of the hole.

The crew on tour at the time the world's record was made: Bob Parmon, Driller; Carl Harris, Driller; C. V. Maxwell, Derrickman; T. E. Burton, Albert Hayes, C. K. Light, Elmer J. Early.

New fame has accrued to the Magna-Tector by its superb performance in the deep well. It operated under the most severe and exacting conditions and gave ample proof of a high degree of perfection in design, as well as inherent ruggedness.

Deeper beneath the surface than any previously drilled hole, Pacific Western's project is known as National Royalties No. 1. Location falls seven miles from nearest production in any direction. It is east of the Lost Hills field and north of the Semitropic gas field.

Inglewood Area Redrill Scene

Cleveland Oil Co. has taken over part of the Hogan Petroleum Co. properties in the Inglewood area, with plans so far formulated calling for redrilling and deepening the old No. 5 well, which is bottomed at 4318 ft.

Diesel Engine Use Widens

The diesel engine was patented by Rudolf Diesel in 1892. Its greatest growth was from 1939 to 1945, when estimated dollar production grew from $45 million to more than one billion dollars.

Petroleum Gases Aid Farmer

Ethylene and propylene gases, derived from petroleum, shorten the growing season for potatoes, tomatoes, grapefruit, and oranges; speed natural coloring; and increase palatability.

The sale of U. S. savings bonds have hit the $59,000,000,000 mark. The Treasury Department reported that in the five years since the Pearl Harbor attack Americans have bought exactly $59,348,000,000 worth of U. S. bonds. They invested more than $52,000,000,000 to help finance the war throug hlast year and in 1946 to date have purchased another $7,000,000,000.

Joseph D. Peeler, widely known Los Angeles attorney, has been elected a director of Tide Water Associated Oil Co. He is a member of the law firm of Miller, Chevalier, Peeler & Wilson, Los Angeles, and a member of the law firm of Miller & Chevalier, Washington, D. C. He was an officer in the air corps in both World War I and II.

Chemicals From Petroleum

All of the known half million organic chemicals can be synthesized from either petroleum, natural gas, coal or farm products—the raw material used depending, in each instance, on the cost of production.

U. S. Natural Gas Reserves

A new estimate places the natural gas reserves of the U. S. at 144.2 trillion cubic feet. This is the fuel equivalent of almost 24 billion barrels of oil.

Crude-oil capacity of existing U. S. refineries exceeds 5,100,000 bbl. a day, a rate of through-put which was attained for a short period in 1945.

A new wall paper coated with DDT has been developed which is fatal to insects, but has no effect on human beings or animals.

ELECTRONIC SLEUTH TRACKS DOWN CORROSION

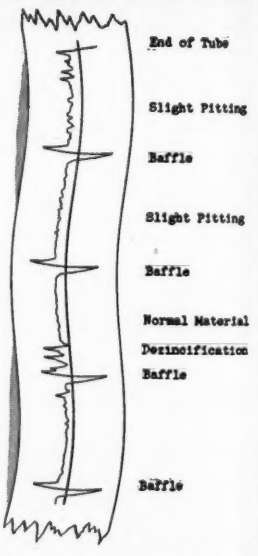
Probolog in use inspecting tube bundle. Picture shows (A) probe puller withdrawing probe at constant rate, (B) recording instrument charting condition of tube.

New Shell Probolog permits detection of defects in tubular equipment . . . with tubes in place . . . before failure!

The PROBOLOG locates eroded and corroded pits, dezincification, cracks, strained areas, and abnormal changes in physical dimensions in non-magnetic metallic tubes. Defects are spotted accurately and quickly.

With the PROBOLOG, your maintenance check-ups will be well *ahead* of trouble . . . ahead of sudden tube failures that cause emergency shutdowns. No more good tubes removed by mistake . . . no more bad tubes left in place!

For more information, communicate with the Shell Development Company, Incorporated, 50 West 50th Street, New York 20, New York.



Actual chart made by Probolog showing defective isobutane condenser tube.

SHELL

SHELL DEVELOPMENT COMPANY, INCORPORATED

Shell Oil Company Completes Test Well Drilled With Horizontal Drain Holes

In the Round Mountain field, Kern County, California, 15 miles northeast of Bakersfield, the Shell Oil Company, Inc., has completed an interesting test of the Zublin Method of drilling horizontal drain holes.

This particular well was chosen for the following reason: The main oil sand is concentrated in an 80'+ body near the bottom of the well; it has 8-⅝" casing which is ideal for this test. No core analysis is available on this well. The general average permeability for this zone is on the order of 100 md.

PRE-DRILLING STATUS

Total Depth: 1720'
Casing: 16" cemented at 30'
Elevation: 1055 D. F.
8⅝", 32 lb. and 36 lb., lapweld cemented at 1381'
6-⅝", 26 lb. used lapweld liner hung 1354-1718'
Perforated 100 mesh, 1379-1718'

DESCRIPTION OF HORIZONTAL DRILLING EQUIPMENT

The bits used for drilling horizontal drainage holes in this test of a Shell well were of the rotary turbine type, with a 6" diameter cutter. Power to rotate the turbine was derived from fluid pumped down the drill string to the bit. In this test the Zublin operators recommended a flow of approximately 7 bbls/min. This flow was maintained in the majority of the holes drilled in this well, necessitating an average pump pressure of about 600 p.s.i.

The Turbine bit assembly consisted of three main parts: the housing which carries the nozzles of the turbine, the shank member carrying the turbine runner, mounted on ball bearings within the housing, and the cutter element which is mounted on ball bearings and is free to rotate about an axis that is inclined with respect to the axis of rotation of the shank.

The cutting action of the bit is credited, by the Zublin representatives, to the tendency of the bit to cut opposing teeth in the formation facing the teeth of the cutter. If the bit were hanging free, the cutter will rotate at approximately the speed of the turbine or about 4000 RPM. However, as the cutter face is forced against the formation, these "rock" teeth retard the rotation of the cutter by the ratio of one to ten: 400 RPM for the cutter about its inclined axis as compared to 4000 RPM of the turbine and shank. The cutter, however, wobbles at the rate of 4000 times per minute due to the inclination of the cutter axis. The one to ten reduction is accredited to the placement of the cutter teeth which were designed to remove one-ninth of the opposing "teeth" in the formation on each revolution of the turbine or the corresponding wobble of the cutter face. The cutting action of the bit depends in part upon the tendency of the cutter teeth to lift and drop the bit.

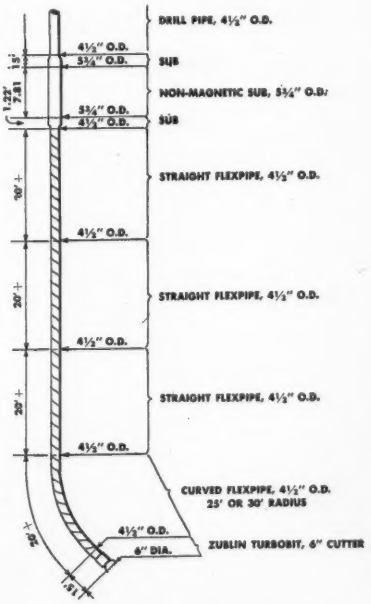
The entire bit has an overall length of 20" to permit the drilling of curved holes. The fluid is discharged close to the cutter teeth. The construction of the bit provides for ready disassembly and reassembly to permit replacement of parts of the turbine worn by cutting or abrasive action of the drilling fluid.

ZUBLIN FLEXPIPE

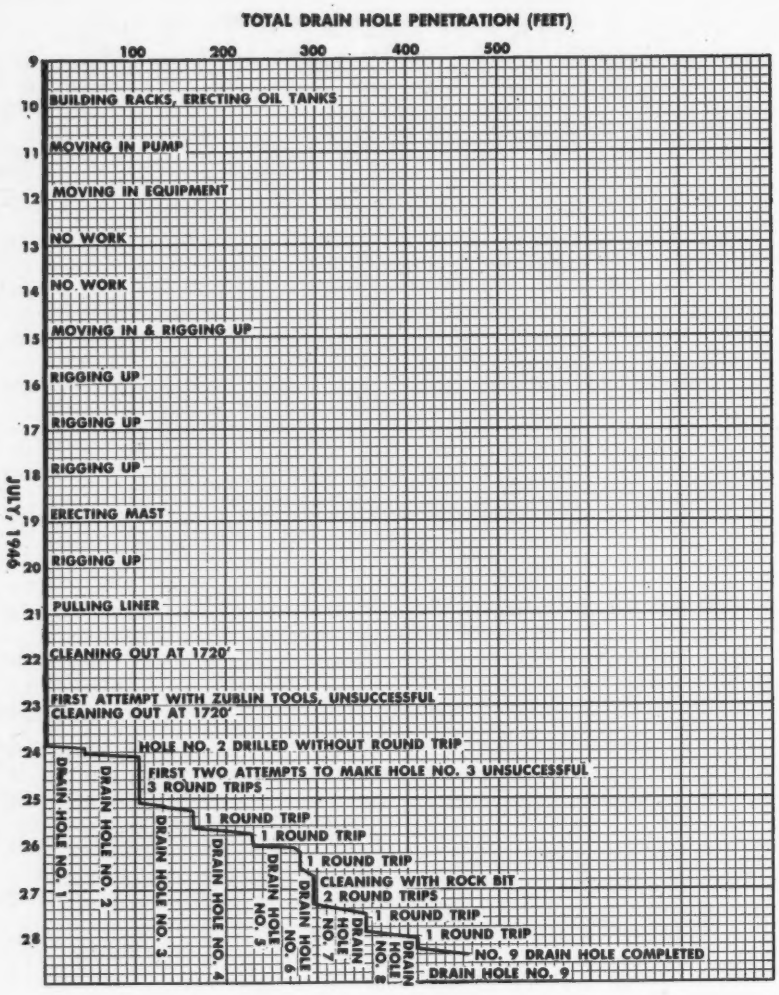
The flexible drill pipe is made from 4-½" external flush joint drill pipe. A continuous spiral slot is cut to change from a vertical hole into pipe except for a distance of 15" at each end. The joint is lined with a high presuure, synthetic rubber hose, made fluid tight at each end to prevent leakage of the circulating fluid. The spiral cutting of the straight flexible pipe provides the flexibility required for the string to change from a verical hole into a curved and then horizontal hole.

The curved flexible joint is used at the lower end of the string directly above the turbobit. This pipe is similar in construction to the straight flexible pipe except that it has been heat-treated to maintain its curved form. The radii of curvature range from 20 to 35 feet. The curved joints used at this well were all 25 feet in radius except for one joint used in drilling two drain holes. This joint had a radius of 30 feet. It is claimed for the 25 foot radius joint that the force of gravity will allow the bit to continue in an approximately horizontal direction once it has reached this position as the bit continues to make hole.

Before being run into the well, a mandrel is inserted as a core through the curved section of pipe. The curved joint is straightened out and held in this position by a clamping device, and the mandrel inserted. The mandrel is equipped with a spear at the top for the purpose of withdrawing it from the curved section of pipe. After the flexible pipe has reached its point of operation, the mandrel is withdrawn by means of retrieving tools run on a sand line. The curved pipe then assumes a curved form



Sketch of Tool String Used in Drilling Horizontal Hole. (Figure #1)



PROGRESS CURVE—HORIZONTAL DRILLNG

within the limits of the hole at this point, forcing the bit against the side wall.

MAGNETIC COMPASS AND NON-MAGNETIC SUB

A Zublin magnetic compass was used in the horizontal drilling operation. With the exception of a steel swivel at the upper end and a steel bull-nose at the lower end, the housing is made of brass, 6'6" overall length and 2-3/16" O.D. The timing mechanism to lock the compass needle is housed in the lower half of this unit. Essentially the unit operates as follows: A compressed spring exerts pressure on a leather packer within the tube; the movement of the packer, which in turn is connected to a long pin, is retarded and controlled by the flow of oil through a small orifice; approximately 12 minutes following the release of the mechanism, the pin compresses a small cylinder beneath the compass needle locking the needle in the position it holds at that moment. The needle will remain locked in this position until released at the surface. The upper section of the housing has a stainless steel, hinged lug designed to orient the compass assembly in the same positions with respect to the non-magnetic sub every time the compass is run into the sub on a sand line.

The sub is constructed of non-magnetic stainless steel and is 7' 10" overall length, 5-¾" O.D. This sub has an internal slot to insure positive orientation of the compass assembly with respect to itself.

PRE-DRILLING PROCEDURE

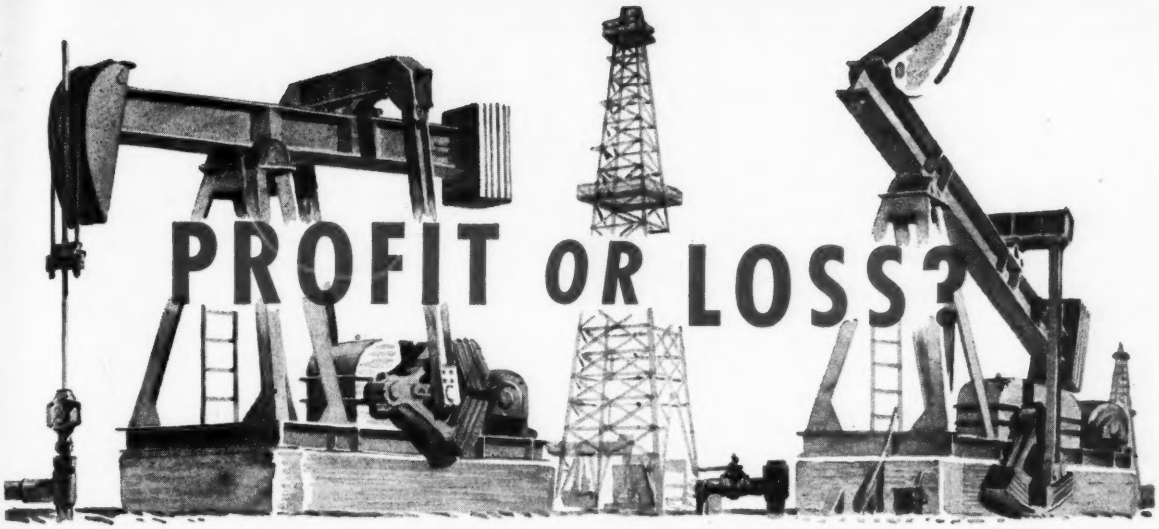
Figure 1 illustrates the typical string of Zublin tools suspended on conventional 4-½" O.D. drill pipe as used in the drilling of drain holes in Freeman 11. With the mandrel inserted in the curved joint of flexpipe this string is run in until the bit has reached the depth at which the horizontal hole is to take off from the vertical. The mandrel is removed and the flexpipe allowed to return to its curved form to the extent the hole will permit.

All joints of Zublin flexpipe and subs, from the curved joint up to and including the non-magnetic sub have vertical alignment marks chiseled at the ends of each joint. These marks, with the aid of a protractor, provide the means for determining the relative angles of adjacent joints. The algebraic sum of angles to the right and left provides the bearing of the non-magnetic sub with respect to the curved flexpipe and bit. The magnetic compass is run in on the sand line until it is positioned in the non-magnetic sub. After an interval of approximately 15 minutes the compass assembly is withdrawn from the string and the compass bearing of the non-magnetic sub is thus determined. With this information, knowing the relative bearing of the non-magnetic sub and the curved flexpipe, the present compass bearing of the curved flexpipe and bit is thus determined. The string of pipe is then rotated at the surface to the desired azimuth.

As soon as the pump is started, the bit rotates and starts digging a new hole in the wall of the vertical hole.

Horizontal drain holes No. 1 through No. 4 were oriented in the manner described above. The remaining holes were surveyed, the string of pipe was rotated, and the mandrel pulled after the bit had been oriented to the direction in which respective holes were scheduled to penetrate formation. This method insured the free rotation of the entire string of pipe during the orientation of the bit. Inasmuch as the mandrel can be inserted in the curved flexpipe at the surface only, the latter procedure necessitated a round trip for each drain hole.

After all lateral holes were drilled, the same size liner was placed in the well as was originally in the



PROFIT OR LOSS?

The Vital Question

A three word question, asked above, represents success or failure, according to the answer... The answer, in deep well oil pumping, frequently is determined by the pump itself... Pumping conditions vary in many fields... Years of experience, under all conditions, have developed an *Axelson Deep Well Plunger Pump* to meet every need... The object, in each case, is to produce the greatest quantity of oil at the lowest cost per barrel... To do this with the greatest assurance against down time, submit your requirements to *Axelson Manufacturing Company* and get the right pump for the conditions encountered at *your* well... Fifty years of scientific know-how and the quality-first rule in materials and workmanship answer your all-important question with the one word—*Axelson.*

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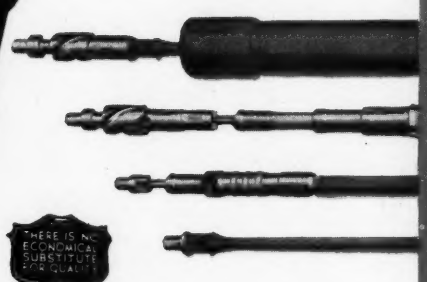

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AXELSON
DEEP WELL PLUNGER PUMPS
AND SUCKER RODS

hole and the well placed on the pump.

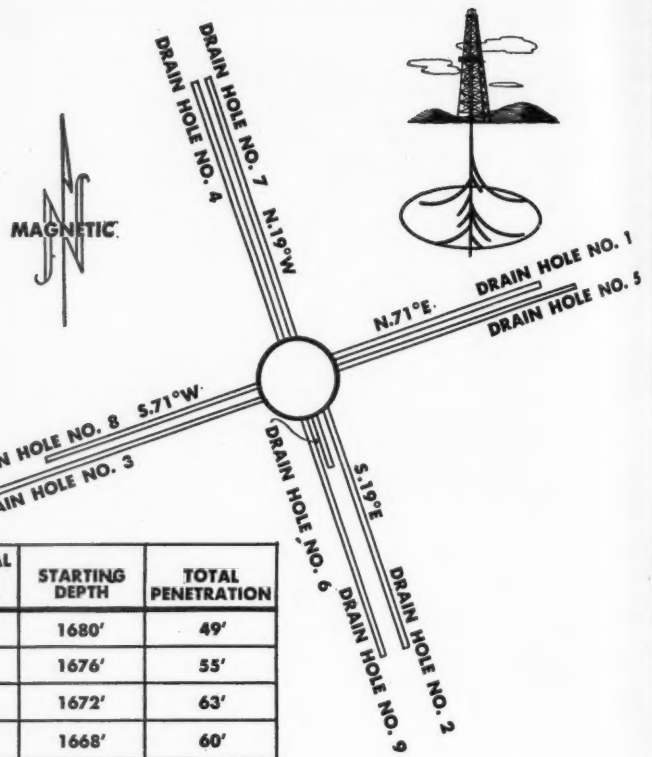
DRILLING FLUID

Anticipating a considerable loss of fluid to the formation, 4500 bbl. oil storage capacity was provided for this operation. However, it was found that approximately 450 bbl. of oil were lost into the formation while removing the liner and 650 bbls. of oil were lost into the formation while drilling the 458′ of drain holes. Thus the actual loss of fluid while drilling the drain holes amounted to 1.4 bbls./foot. The rubber lining of the Zublin flexpipe has a bursting pressure of 100#/sq. in., consequently care must be taken in selecting a fluid which will permit the desired rate of circulation 6-10 bbls./min. with a maximum pressure of less than 900#/sq. in., in the flexpipe just above the turbine bit.

There is no apparent relationship existing between the drilling rate and the circulating volume. The discrepancies in the pump pressures and circulating rates as shown on the above charts are probably caused by gas locking in the pump, since the actual pump displacement was not measured but merely calculated from the pump speed.

CONCLUSION

Sufficient evidence of cuttings in the ditch and weight on the bit was observed to indicate that nine drainage holes had actually been drilled.

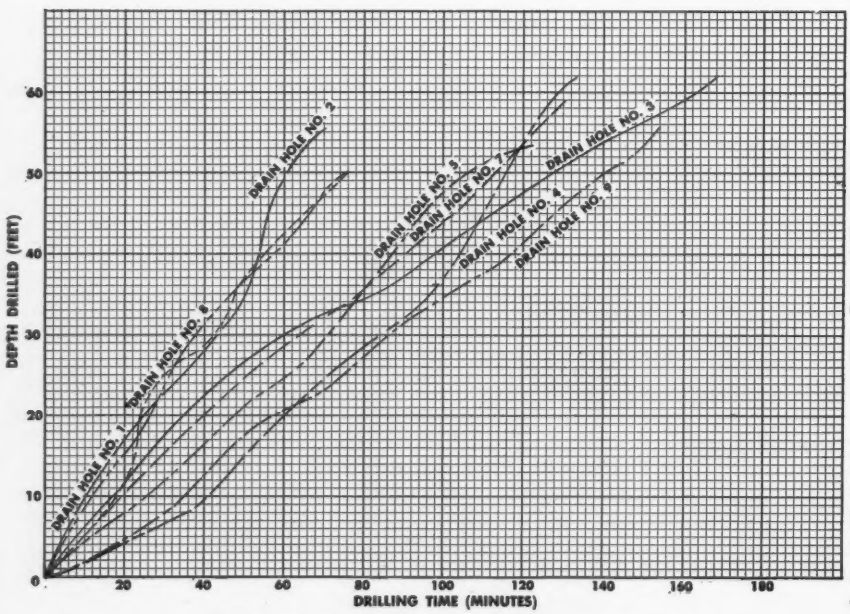


HORIZONTAL DRAIN HOLE NO.	STARTING DEPTH	TOTAL PENETRATION
1	1680′	49′
2	1676′	55′
3	1672′	63′
4	1668′	60′
5	1664′	54′
6	1660′	13′
7	1660′	60′
8	1656′	49′
9	1650′	55′

DIAGRAMMATIC SKETCH SHOWNG SCHEDULED ORIENTATION OF HORIZONTAL DRAIN HOLES

The Zublin turbobit performed satisfactorily on all drain holes. Frequent bit changes were made but this was done to insure trouble-free drilling inasmuch as round-trips were necessitated in any case by the adopted method of orientation. At no time could failure to penetrate formation be attributed to the performance of the Zublin bit. A total of four bits were used in drilling the 458′ of hole, although considerably more footage could have been drilled with the bits since they were not very dull.

The Zublin flexpipe performed satisfactorily in the majority of drain holes drilled. In the few cases where the pipe actually ruptured, halting further drilling progress, the failures were attributed to excess weight on the bit. In one case, a faulty weight indicator was the cause for application of



DEPTH VS. TIME CURVES—HORIZONTAL DRILLING

excess weight on the bit and flexpipe. Zublin representatives recommend approximately 1000# as the ideal weight on the bit for drilling with their equipment.

Although the drainage holes were stopped after penetrating 50′ to 60′ into the formation, it is believed that the holes could have been drilled much further (80′ to 100′) without any mechanical difficulties.

COMMENTS BY INVENTOR OF HORIZONTAL DRILLING METHOD

In commentinig upon the test made in the Shell well described above, John A. Zublin stated that a significant improvement was introduced into the test in the use of oil instead of water or water based mud as the motivating fluid for the turbine. This new technique, he states, has eliminated the danger of impairing production by water flooding or "mudding" of the oil sand and has the added advantage of furnishing a helpful lubricating action.

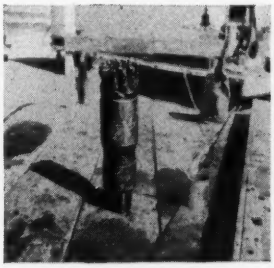
He further stated, "Results of this latest drain hole project have again confirmed our belief that one of the benefits of large drainage channels is to greatly reduce sand troubles. The rate at which oil flows through the large drain holes is so much less than in the case of ordinary wells, where only minute passages or cracks are available, that less sand will be dislodged and in any event will settle out before reaching the main bore of the well. This will result in considerable savings in liners, pumps and other production equipment, as well as reduce the danger of wells sanding up.

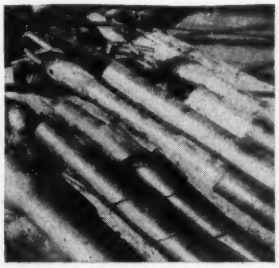
"Thus far, drilling of horizontal drain holes has been confined to 'old' or partially depleted wells, and all projects have been approached as methods of secondary recovery. It may well be, however, that far greater benefits will be derived from drilling in 'new' wells. This would mean drilling horizontal holes into the oil sand immediately upon completion of the vertical bore and prior to placing the well on production. With a greatly increased drainage area, and unimpeded passages for the oil to travel from all directions to the central hole, the new well could be produced at a much higher rate without exceeding the limits of efficient production or encouraging sand problems, or other problems. Production of a well is in a sense an underground transportation problem involving the movement of oil and gas from distant points in the formation to the well with the least amount of turbulence and resistance to flow. In conventional wells the oil and gas must force their way horizontally at high velocities, through small openings and pores in the sand to a point in the well from where it will be lifted vertically and it is to be expected that in this 'race' the more viscous gas will tend to by-pass the oil. The slow and uniform drainage created by lateral holes, will preserve the gas pressure in the formation and maintain a more constant and controlled gas-oil ratio. These factors will undoubtedly bring about a greater ultimate recovery of oil, as well as a more rapid and consequently more efficient and economical recovery. This same contention applies to decreased water production, since, similarly, the tendency for the water to by-pass the more viscous oil, is less at a slower rate of production. This point has been definitely brought out in the tests thus far completed, since in all wells the percentage of water produced declined after completion of the drainholes.

Elements required to horizontally drill an oil well, consist of straight mandrel to insert in curved flexpipe drill pipe which directs the hole away from the vertical hole and the turbine bit connected at end of curved flexible pipe actuated by high pressure drilling.

"Considerable thought has been given to the problem of reducing costs of drilling lateral holes. Since, in the process employed, the pipe remains stationary and only the bit rotates, no torque is set up, making

(Continued on Page 47)





(a) Shell, Freeman-11 viewed from oil tanks on hill north of well.
(b) Zublin Turbobit-6″ Cutter. This bit had been used in drilling drain holes No.1 and No. 2.
(c) Ruptured Flexpipe resulting from application of excessive weight on bit during drilling of Hole No. 3. In this case it is estimated that up to six points of weight were applied on the bit. The weight indicator was not functioning at the time this weight was applied.
(d) Zublin bit orientation equipment, showing protractors, compass housing and magnetic compass.

Field Development

PREPARED FROM CALIFORNIA OIL WORLD NEWS SERVICE

Los Angeles Basin

Beach Try Sets Pipe

Hiawatha Exploration Co. has set casing on bottom of 3175 ft. Atha No. 4 in Sec. 13-6s-11w in the West Newport Beach area. The try is credited with 160 ft. of oil sand to bottom in the A and B zones. The company may drill out and core ahead or stop at present depth and gun perforate for conventional tests.

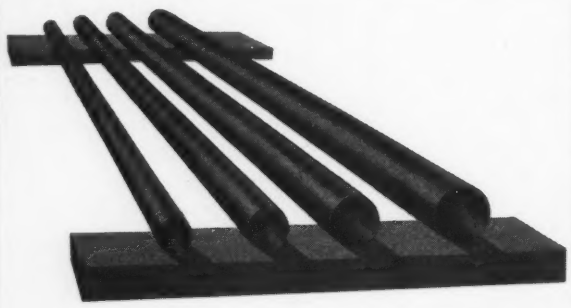
The well, located due south of No. 3, apparently is about 20 ft. lower on structure than its immediate predecessor. The No. 3 was completed about five months ago and presently makes an average of 300 barrels of oil a day. D. D. Dunlap Oil Co.'s Aldrich No. 4 is standing with casing cemented at 2817 ft. Totol depth is 2822 ft. Location for Aldrich No. 5 has been made in Sec. 18-6s-10w, about 480 ft. southeast of Aldrich No. 3.

Castaic Area Active Center

In the general vicinity of Castaic, Barnsdall Oil Co., Dodge No. 1 in Sec. 32-5n-16w is spot coring and drilling on down at a depth of 4180 ft. Republic Operators, Inc. Fee No. 1 in Sec. 13-5n-17w is drilling at 2792 ft. Universal Consolidated Oil Co., Devils Canyon No. 1 in Sec. 27-5n-17w is about to spud.

Berdoo Test Stands Idle

Grayco Oil Co.'s Mahla No. 1 in Sec. 13-3s-8w in the Chino area, San Bernardino County, last was reported inactive at 4170 ft.



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Whittier Tester Sets Surface Pipe

Calumet Gold Mines Co., Delaney-Cinnabar No. 1 in Sec. 24-2s-11w in the Whittier area has set surface pipe on bottom at 200 ft. and is ready to drill out.

Alondra Well Plans Retest

On production test of 9230-9250 ft. British-American Oil Prod. Co.'s Alondra Park No. 1 in Sec. 22-3s-14w in the Alondra Park area showed wet and the 7-in pipe at 9230 ft. was recemented, preparatory to a retest. Total depth is 9253 ft. Bodger No. 2 in the section is drilling at 2834 ft.

The Texas Co., Operator, Gardena Comm. No. 9-1 in Sec. 26-3s-14w in the Gardena area is drilling at 9874 ft. in gray conglomerate. Electric log was run to 9803 ft.

Boyle Heights Well Disappoints

After running electric log for a final check, Richfield Oil Corp. decided to abandon its Boyle Comm. No. 33-1 in Sec. 31-1s-12w, in the East Los Angeles area. The hole went first to 5902 ft. and on a redrill to 5650 ft. U. P. Unit No. 3 in Sec. 16-2s-12w is making hole at 8325 ft. Formation tests conducted somewhat higher recovered mostly salt water.

Corona Del Mar Wildcat Drills

In the Corona Del Mar district of Orange County, Morton and Sons is drilling Irvine No. 55-1 in Blk. 55, Irvine Subdn. below 650 ft. Surface casing was set at 500 ft.

Standard Busy In Basin Areas

Standard Oil Co. has no less than six wildcat tests going in Los Angeles Basin area.

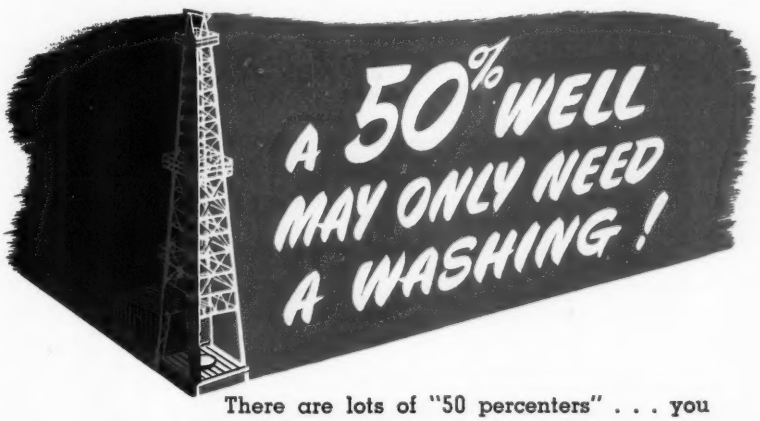
Carmenita Comm. No. 1 in Sec. 4-3s-11w in the Santa Fe Springs area is digging ahead at 10,899 ft. Newsom Comm. No. 1 in Sec. 36-2s-12w is making hole at 6907 ft. Near Garden Grove in Orange County, Stanley Comm. No. 1 in Sec. 33-4s-10w has reached a depth of 6408 ft. and is continuing to prospect ahead. Roobier No. 1 in Sec. 15-4n-17w in the Del Valle area, and German Comm. No. 1 in Sec. 14-3s-11w in the Leffingwell area, are starting preliminary work.

Dominguez Try Plugged Back

After plugging at 10,580 ft. Union Oil Co. is cleaning out its Hellman No. 58 in Sec. 27-3s-13w in the Dominguez area. Drilled to a bottom of 10,921 ft. a fishing job left 217 ft. of 3½-in. drill pipe in the hole. Top of pipe is placed at 10,690 ft. The hole was bridged at 10,687-10,668 ft., and redrilled to 10,696 ft., after whipstock was set.

Whittier Job Tests Oil Sand

Testing was the latest word from J. Paul Sievers' Atlas No. 1 wildcat in Sec. 17-2s-11w in the Whittier area. Bottomed at 3275 ft., oil sand was topped at approximately 3000 ft. Casing is set on bottom.



There are lots of "50 percenters" . . . you know them. Fair wells, paying their way — but not as good as they should be. Their tests gave promise of much greater production; nearby wells are bringing in twice as much from the same formations. And, surprisingly enough, there's only one thing the matter with most of them.

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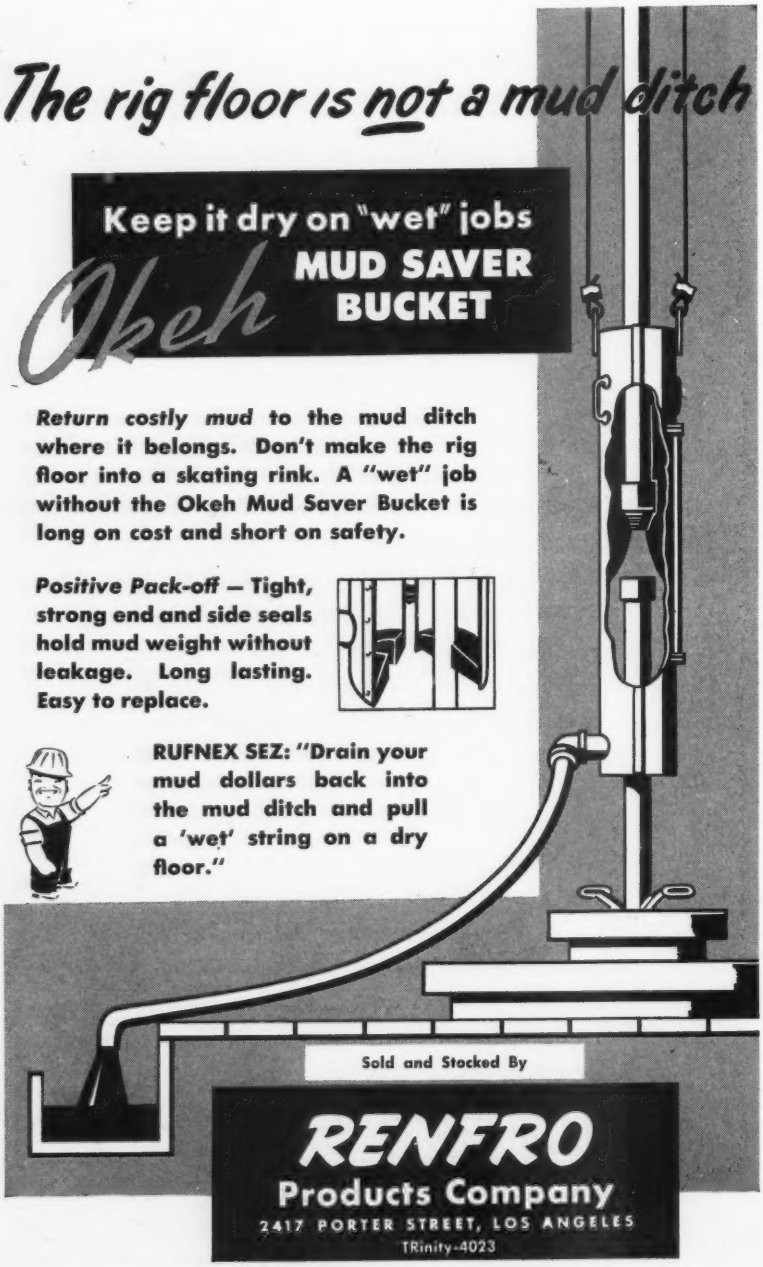
San Joaquin Valley

Kettleman Project Reaming For Tests

Having cored an oil sand of some degree of importance in going to a bottom of 12,317 ft. with its No. 73-30V in Sec. 30-23s-19e in the Middle Dome area of Kettleman Hills, Standard Oil Co. is reaming for a conventional formation test.

This well has been the center of interest for some months, as a strike of commercial importance at this location would open a wide area to new deep drilling. Bolsa Chica Oil Corp. shares a 25 per cent interest in the current play. In addition, the company is the holder of considerable surrounding acreage in its own right.

In the Sheep Springs area, Standard is coring at 7658 ft. with E. W. P. No. 46-33W in Sec. 33-20s-21e.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No. 213-35A in Sec. 35-19s-15e in the Coalinga area is making hole ahead at 5431 ft.

Temblor Well Explores Ahead

Calumet Gold Mines Co., FOB No. 2 in Sec. 31-29s-21e in the Temblor area continues to make hole ahead at a depth of 2146 ft. The well is located on a 374-acre lease.

Arvin Well To Go Deeper

Western Gulf Oil Co., Di Giorgio No. 1 in Sec. 10-31s-29e, which recently went to 6163 ft. for a new oil discovery, is ready to go deeper in a hunt for a more satisfactory yield. In the San Emigdio area, No. 4 in Sec. 18-11n-22w is idle at a redrilled depth of 3210 ft.

McKittrick Tests Prospecting Down

Wilshire Oil Co. was last reported drilling ahead at a depth of 6144 ft. with its McKittrick No. 2 a wildcat test in Sec. 12-30s-21e in the McKittrick area. Tide Water Associated Oil Co.'s Midway-McKittrick No. 5-32 in Sec. 32-30s-22e, meantime, is digging hard brown shale at 4914 ft. In Sec. 29-30s-22e, The Texas Co. has made location for West Pet No. 2 No. 1, which produced an ample supply of crude oil from 5173 ft. is shut in.

Belridge Job Stage Testing

Perforating and testing by stages comprises present activity of Belridge Oil Co.'s No. 62-W-33 deep test in Sec. 33-28s-21e in the South Belridge area. Total depth is 13,975 ft., with pipe set at 13,944 ft. Richfield Oil Corp., Berry No. 1- in Sec. 30-28s-21e is descending downward at 7372 ft.

Arvin Wildcat Rigging Derrick

Tide Water Associated Oil Co. is rigging derrick to start the drill in its Tupman No. 23-9 in Sec. 9-31s-29e in the Arvin area. Bolsa Chica Oil Corp.'s Di Giorgio No. 8-3 in Sec. 3-31s-29e is a location.

Round Mountain Explorer Spudded

Continental Oil Co. has spudded its M. & T. No. 1 in Sec. 33-28s-29e in the Round Mountain area and last was reported down 1470 ft. Foundation is in for K.C.L. No. 1-1 in Sec. 11-11n-22w in the San Emigdio area.

Corcoran Test Finds Gray Sand

G. P. Finch, Williams Trust No. 1 in Sec. 24-20s-22e in the Corcoran area, Kings County, has been abandoned at 8205 ft. in basement material. A core at 8159-8173 ft. was Eocene gray sand.

Tulare Test Starts Drill

In the Kings wildcat district of Tulare County, Frakes Oil Co. is drilling its Toscan No. 1 in Sec. 28-16s-23e at 560 ft.

Cantua Creek Try Makes Hole

In the Cantua Creek area of Fresno County, where in past years several wildcat tests have gone down to production defeat, Texas Co. has spudded its Dahlgren No. 1 in Sec. 7-16s-15e, with drilling below 100 ft.

Williams Test Going On Down

On the Williams anticline in Kern County, Signal Oil & Gas Co. is exploring ahead at 3219 ft. with Signal-Honolulu-Carpenter No. 1 wildcat test.

Grapevine Try Standing Idle

Reserve Oil & Gas Co., No. 1-A-21 in Sec. 21-11n-19w in the Grapevine area bailed water with a trace of oil from perforations between 4992 and 5002 ft. and the well is idle. Total depth is 5383 ft. with plug at 5070 ft.

Geological information gathered in carrying the well to bottom will be a factor in determining future well locations. The well was whipped directionally after encounter with a fault, an occurrence that probably worked against consummation of a perfectly normal test. The company's lease of 2300 acres probably will be the scene of a new test shortly after the turn of the year.

Reserve, meantime, is making arrangements to move over to old territory on the Tejon ranch and drill a Chanac zone job in Sec. 33. On the O. M. B. lease in Sec. 32 and 33, Drilling & Production Co., contractor, will drill six Chanac wells early in 1947. C. C. M. O. Co. is coring at 2175 ft. with No. 10-32 in Sec. 32-11n-9w.

Ten Section Test Deeper

Shell Oil Co.'s KCL-A No. 53-30, a deep test in Sec. 30-30s-26e in the Ten Section field is drilling ahead below 11,600 ft.

Lost Hills Wildcat Spuds

Southwest of the Lost Hills field, Richfield Oil Corp. is drilling Buck No. 1 test in Sec. 6-27s-21e in surface formations around 150 ft. C.L.-A. No. 21-33 in Sec. 33-30s-25e in the Coles Levee area is making drilling progress at 13,723 ft.

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Coastal and Northern District

Arroyo Grande Drilling Plans

Adams Oil Co., a new corporation, has been organized by the joint action of Southern California Petroleum Corp. and W. O. and J. I. Anderson.

The new company has taken over and will develop holdings of principals situated in the Edna-Arroyo Grande oil field. Work is scheduled to start immediately on the company's ground, which embraces about 500 acres in proven territory and considerable more probably will be added from time to time as development progresses.

A drilling program of 15 wells has been mapped out for the Dollie Adams Fee lease and the Consolidated Rock Bituminous Rock Co. lease. The leases already boast 17 producing wells.

The new wells will be bottomed in the Dollie sand, generally found above 1500 feet. The zone ranges in thickness from 300 to 400 feet. Wells to this zone will be spaced one to each four acres.

Undeveloped surface oil deposits in bituminous sand enhance the company's property. These holdings are said to rank with the largest deposits of this type in western United States. Research now is being carried on looking to the anticipated decline of oil production on the Pacific Coast.

Adams Oil officials have made it known that the new corporation intends to continue modernization of field facilities and equipment. A new blending and refining plant may be constructed shortly after the turn of the year on the company's loading rack on the Southern Pacific main line.

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San Ardo Oil Try Cemented

The Texas Co., Aurignac No. 2A in Sec. 4-23s-10e in the San Ardo area, Monterey County, is standing with casing cemented at 2130 ft. Bottomed at 2675 ft., the project ran into mechanical difficulty when the surface pipe parted at 448 ft., leaving a 52-ft. fish at 957 ft. The company, however, cleaned out through fish to 2500 feet and ran electric log, before running casing.

In Sec. 6, C. C. M. O. Co. is drilling very hard formation at 800 ft., with its San Ardo No 6-G1.

King City Test Laying Aqua Lines

Shell Oil Co. is laying water lines for its Honolulu-Thorup-USL No. 1 exploratory venture in Sec. 4-20s-7e in the King City area, Monterey County.

In the Ventura Avenue field, Ventura County, Shell has eight drilling jobs at various operational stages.

Conejo Project Makes Location

On the Rancho Calleguas, David A. Barth has staked location for No. 4 in Sec. 32-2n-20w in the Conejo area, Ventura County.

Sandberg's Petroleum Janss No. in Sec. 33-2n-19w is idle at 5620 ft.

West Mountain Venture Tests

Squeezed after water shut off was o good on four holes at 2628 ft., F. . Fairfield is again testing Rich-rdson No. 2 in Sec. 23-3n-21w in the West Mountain area. Converse No. on the Section is rigging.

Montalvo Test Making Progress

Standard Oil Co. is drilling on own at 10,314 ft. with its McGrath o. 2, an interesting wildcat test n Sec. 26-2n-23w in the Montalvo rea, Ventura County. Luck of the rill to present depth has not been isclosed by the company.

Ojai Producer Repairs Pump

Pump is being repaired on Fill-more Drilling Co.'s Ojai No. 1 in ec. 12-4n-22w in the Ojai area, hich recently was completed for yield of 33 barrels of oil daily, utting 30 per cent. The 7-in. casing s set at 1024 ft.

Rincon Wildcat Reaches 5560 Ft.

With hole bottomed at a depth f 5560 ft., Honolulu Oil Corp. is ngaged in cleanout operations with s Honolulu-Signal-Bates No. 1 in he Rincon area.

Capitan Well Testing Sespe

Following effective water shut off n perforations between 1750 and 800 ft., Rothschild Oil Co. is test-ng with Orella No. 1 in Sec. 31-5n-0w in the Capitan area at intervals n the Sespe. Total depth is 3140 t. with casing set at 3015 ft.

Madera Venture Testing Higher

On formation test of the interval f 3612-3922 ft., Thomas M. Blake's huck No. 1 test in Sec. 28-10s-17e n the Madera area of Madera Coun-y recovered mud and salt water, ith the result a test higher is lanned. Total depth is 3922 ft. in chist, top of which is placed at 560 ft.

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Los Alamos Try Running Tubing

Rods and tubing are being run in Whittier Associates, Barham No. 3 in Sec. 11-7n-32w in the Los Alamos area, Santa Barbara County. Total depth is 6870 ft., with plug at 6565 ft. Casing is set at 5530 ft.

Fillmore Try Redrills

Efforts to re-enter old hole were unavailing and E. E. Perkins, Wileman, Ross & Couget is redrilling at 548 ft. with No. 1 wildcat test in Sec. 26-4n-20w near Fillmore, Ventura County. Original depth is 1532 ft.

Cholame Try Drilling On

In the Cholame area of San Luis Obispo County, Buaas Development Co. is making hole ahead with Jack No. 1 in Sec. 19-25s-16e below 2950 ft., without intimation of what may have been uncovered of interest to present level.

Camarillo Job Digging On Down

Drilling is following a conventional pattern at a depth of 3750 ft. in The Texas Co.'s Broome No. 1 test in Sec. 29-1n-20w in the Camarillo area.

Bay Area Tests Idle

E. T. Willard's No. 2 and Ormonde No. 1 in Sec. 15-6s-5w in the Half Moon Bay area of San Mateo County are inactive at 2100 ft. and 2000 ft., respectively. No. 3 was last reported down 1300 ft.

Santa Paula Well Tests Wet

Oscar J. Smith, Anlauf No. 7 in Sec. 21-4n-21w at Santa Paula Creek is standing idle at 1453 ft., after splice tested wet. Pipe is set on bottom.

Yolo Job Gives Up

General Petroleum Corp. decided that 4912 ft. was far enough to go for new gas supplies with its Galler kamp No. 1 in Sec. 10-6n-3e in th Courtland area of Yolo County an the test has been abandoned as production failure.

Winters Test Fishing Pipe

Fishing for drill pipe, top o which is placed at 1400 ft. is th order of the day at Shell Oil Co.' Winters Unit No. 2-1 in Sec. 18-8n 1e in the Winters area of Solan County. Wagenet No. 2 in Sec. 19 4n-1e in the Kirby Hills is only a ri

Round Mountain Sets Pipe

M. R. M. Syndicate, Claire No. in Sec. 22-28s-28e in the Roun Mountain wildcat area is standing with casing cemented on plug a 2715 ft. Total depth is 2945 ft with Upper Vedder oil sand at 268 ft. and base at 2715 ft. Lower Ved der gray sand was topped at 2928 ft

In Sec. 30-28s-29e, Par-Bell Oil Co. is coring at 1275 ft. with Conry No. 1.

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Kern County OIL NEWS

FROM KERN COUNTY TO AN FRANCISCO THIS MONTH ent more than 21 delegates who ppeared at the annual convention California's big State Chamber Commerce. A survey conducted your correspondent revealed that ore than 65% of the Kern contin- ent represented your oil interests. nd that is at it should be in view f the importance of the petroleum ndustry.

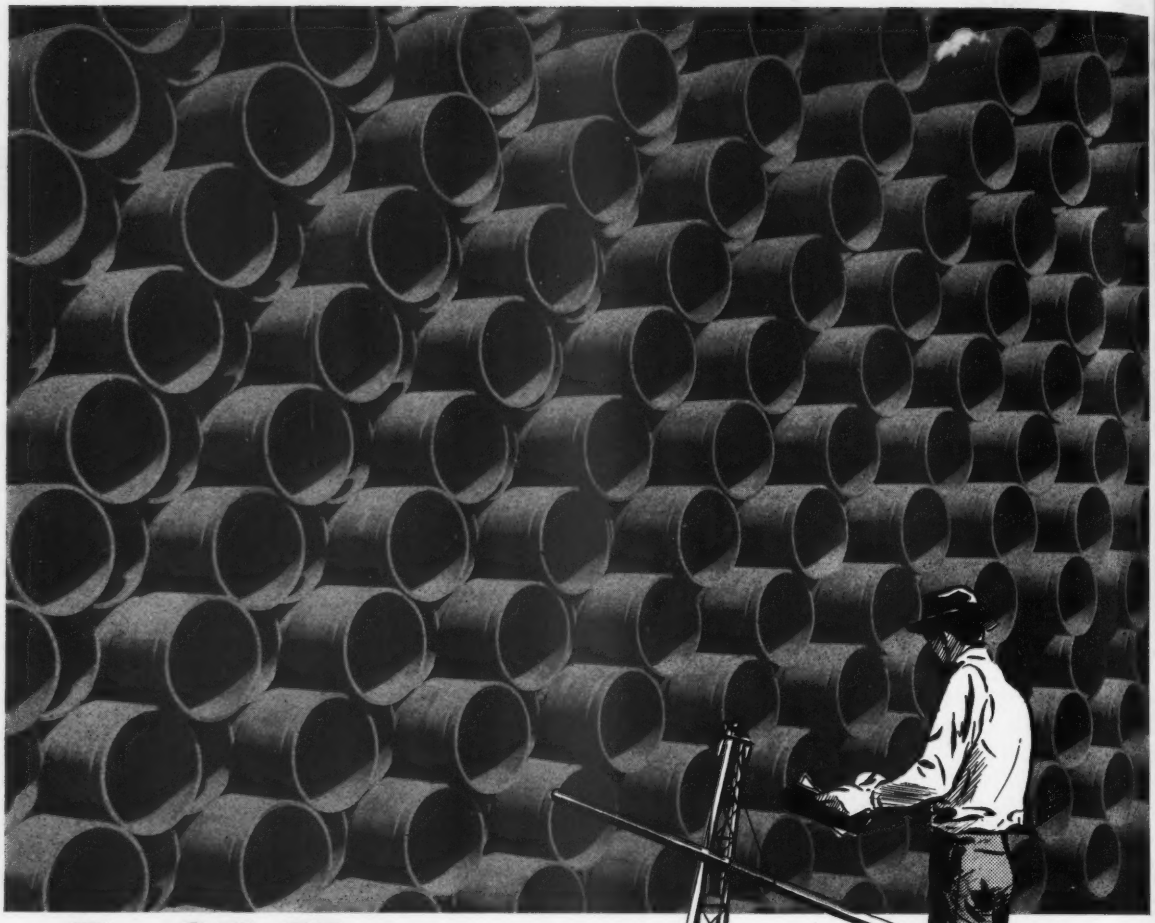
TED HUGGINS of Standard, ERT MATTEI of Honolulu especially, and to say more of the representatives from "G.P.", Richfield, Union, Shell and a half score of INDEPENDENTS were certain for another time that Kernoilwig's civic representatives, after all are cognizant of the importance of petroleum in the "golden empire" of Kern. Also there were Kern County officials and departmental headwigs who were pitching two programs, one for tax reduction and the other for an opportunity to make known new resources and uses of oil and its by-productile opportunities. Here was a source of mutual aid.

GEOLOGISTS ARE HUMAN after all, and one night a fortnight ago when one fellow scout had nothing else to do, what with his wife out of town, and his neighbor unable to find a babysitter, volunteered to try his ambition to do it. Commendable is it indeed when we stop to think of it, the he-babysitter has no children of his own. Declared he, "It was an education for me, particularly when theoretically I

VALLEY SCOUTS: Every Wednesday morning San Joaquin Valley OIL SCOUTS, the folks who know production progress best, are engaged in a work session before the commodious table of the Directors' room of the Kern County Chamber of Commerce, in Bakersfield where new headquarters for the oil scouts has been recently suggested in an exchange of good public relations and county services.

Left to right, Seated: Al Kerr, Ohio; Ralph Brodek, Western Gulf; Tom Bibb, Texas; Bob Patterson, Shell; Tom Fitzgerald, Richfield; Laura Phillips, Standard.

Standing: Bob Hackett, General Petroleum; Mike Adams, CCMO Co.; Roy Fletcher, Texas; Floyd Johnson, Honolulu; Don Davis, Union; Zina Bissell, Southern California Gas; Jim O'Flynn, Richfield; Doyle Graves, Amerada; Dick Haines, Continental; Glen Black, U.S.G.S.; Ken Ward, Standard; Gene Powell, Barnsdall; Fred Green, Tide Water Associated; Bob Rist, Standard, and J. J. Seib, Conservation Committee of California Operators.



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earned more money at it than I did when 'ruffnecking' it a few years back."

JEAN PHILIPP OF NATIONAL SUPPLY rakes his own autumn leaves. How many others on supply row do this no one knows, but judging from the putter like strokes it appeared that it might be good practice before one gets too far along to play golf.

WHEN STANDARD OIL'S ATLAS TIRE inspector fails to find a blemish on an apparent claim due adjustment there are more ways than one to skin off the tire for a replacement. Recently when all mechanics exhausted their skills and the tire was good as new but the customer had a worry wart complex, the Standard gave him a policy adjustment as they do not like to worry about customers' habits who trade with them 25 years.

NO, MR. INQUIRER, LAKE CHARLES has no relation to Charles Lake and it was not a typographical error. Lake Charles (city of 50M plus) is in Louisiana, a great oil well supply center. Charles Lake is the name of the Managing Owner of Western Oilfields Supply Company. Perhaps you have seen his advertising or better yet his golf.

API'S SAN JOAQUIN VALLEY CHAPTER AT TAFT: Subsequent to the annual election Chairman Keller Grigsby sends in his cabinet for the new year. Standing: K. C. Vaughn, Union Oil; J. P. Shea, Richfield; H. S. Stark, Honolulu; H. V. Dodd, Division of Oil and Gas; Don Koch, Superior; J. L. Stephens, CCMO; O. A. Cavins, Standard. Sitting. E. J. Coenen, G. P.; P. J. Craner, Standard; Keller Grigsby, Norwalk; and A. B. Newby, Southern California Gas.

GOVERNOR EARL WARREN announced recently that E. C. (Curley) Emmons of the Emmons Supply Company, Taft, had been reappointed for another term to the Te-

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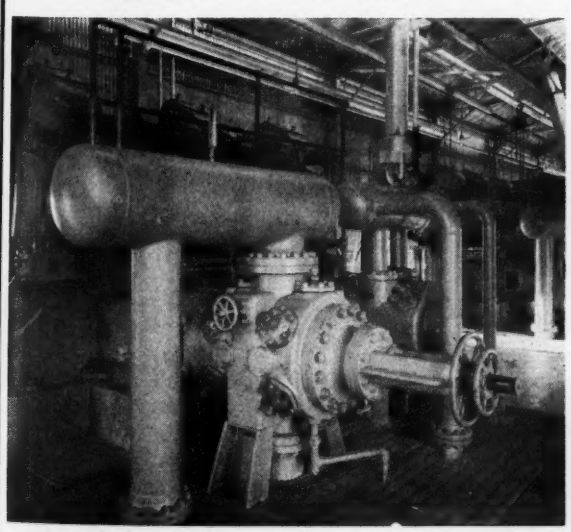

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hachapi location of the California Institute of Women. Kern Oilmen were in unanimous accord with Curley's appointment in view of grand performance turned in by him since his first term when former Governor Olson offered Emmons the post. The work requires a capacity for great understanding and patience with the problems inherent to an institution repairing society's unfortunates. Emmons' influence for good has assisted in bringing about educational improvements and vocational progress for those rehabilitating themselves and paying society's claims.

BENEATH FOG BLANKETS that cover Kern in each December, the oil industry reached for more crude to dig itself out of diminishing now supply to conquer. While drilling racks still were a barometer for production activity, demands for labor slackened off noticeably.

WORLD RECORDS FOR DRILLING depths and many other "tries" for oil could not "impressive make" the year's end inventory of production anything at all to shout about.

IF GLOOM befell the atmosphere, however, it must have been the weather. For many plans go on despite the heavy pressure from the stratosphere that manufactures pea-soup climate here. This time the old Pacific helped to supplement the mist that hugged the earth of Kern, and California as a whole was fog quilted. Air and tourist gas sales lagged.

TO US IN KERN THIS MONTH has come the news again from one that "knows", that overshots in yields in two San Joaquin Valley areas are still way out of some control. Sooner or later now it is feared that cutbacks will obtain untimely, with small chance of equalization to all the program boys. Production to storage is being carefully watched.

LAST YEAR THE OILFOLKS HERE complained about the Christmas cheer that covered up old landmarks. This year "they" cut down the old pine tree and planted it squarely in front of Padre Garces at the traffic circle. So going North on Chester people are reminded what will happen when U.S. 99, the "Main Street" of California, be

ins its descent under the circle, nd the statue will be removed. Can't make everyone happy at Christmas time but it helps a lot hen anyone can.

DOLLAR VOLUME still outoes the tonnage appraisal, as oilvigs talk of retail prosperity in other ines. Bank debits in Kern were usher proportions in 1946. Incone rom agriculture is threatening to urpass again for the second time in Kern's history, that of oil. This vorries assessors and farmers alike.

YEAR END PERSONNEL inovations continue to be on the regular announcement agendi of the arious operators here, particularly he so called "big ten" category. From time to time your scribe will ry to spot news, any changes, as ll seem pointing up to satisfactory ewards for long and faithful service.

ANGUS CRITES is having anther one of those famous "oilwigdings" in company with national, tate and valley producers associaions. Circle your calendar now.

SAN JOAQUIN VALLEY SCOUTS have changed their meeng place and now bid fair to permanentize a workshop weekly sesion at the county chamber of comerce building. Floyd Johnson of he Honolulu is now headman and ellweather. At the close of his six months term it may well be said hat he secured for permanent headquarters the big directors room each Wednesday morning. Chamberwigs nd staff members seem anxious to do something for the industry's cout welfare.

AT FELLOWS in the most Southwestern part of Kern, the Xmas lane of CCMO is once again bout to be re-lighted. The blinking ights of Santa Claus outdoes the inkle of the bells, but down at Rumbold's Square the tinhorn reinleer really cops the show.

IT'S STRANGE how some forget o tell the story of the "slowed up" well. Not long ago in some Kern reas the gas was traded for electric power. The rhythmetic constancy now of pumps has regulated average B/D despite some claims that crude slips back for re-ejection. All changes seem to be for most the best.

WE SAW BERT MATTEI at San Francisco. He was holding down one end of the directors' table at big State Chamber's annual meeting. He was also holding up the oil producers' end of opportunities that smack of future problems. We had an assuring reaction to the extent that if any improvements come to oil, Bert Mattei of Honolulu will have a part in making them.

BEGINNING THE NEW YEAR reminds Kernfolks of the beginning of oil. Here in the North Kern River area lies the landmark commemorating the discovery of the first commercial oil well in Kern County. There are many other firsts in Kern particularly in oil but all are unrelated as to the importance of this particular field. Here lest we forget was also the beginning of "Individual entrepreneuring" in private enterprise as well as the meteoric rise in "big ten" operations.

AT LEAST THREE PERSONS in the postwar years are slant drilling so to speak, for reconversion be that as it may. At Taft we saw the Emmons Supply backlogged with services requested for portable repair maintenance. And Curley tells us that he has to "rigup" for the deepsters.

THEN JOHNSON VALVE reached out for wineries and copped the service at Di Giorgio. So in keeping with Kern's history of diversified opportunity, it now appears that old "iron curtain" will ring down on any "bull sessions" about depression.

AND THAT'S NOT ALL for Charley Lake has "trust-invested" many services at his (WoSco) Western Oilfields Supply to be a cushion of prosperity for much too talked of "rainy days" ahead.

WE COULD ADD FOUR to our new list of preparations for stability. The fact that Charley Manley of Oilfield Construction created a home town organization dispels the synthetic prejudice of remote control that often sets in on a world recession. All power to these lads, especially when their civic mindedness in running display ads to earn the space exchanged for news about their business and their county.

A FORTNIGHT OR SO ago some angry voices cried for their last copy of the "COW" which had expired about the close of 1946. Since no subscriptions carry marginal time for renewals, and this condition was explained, some checks went forth to usher in renewals. PLEASE send such checks direct to Los Angeles office . . . we only write the news . . . if we can find it. Kern oilwig advertisers are glad to know that their banner is carried to those who guarantee to receive it.

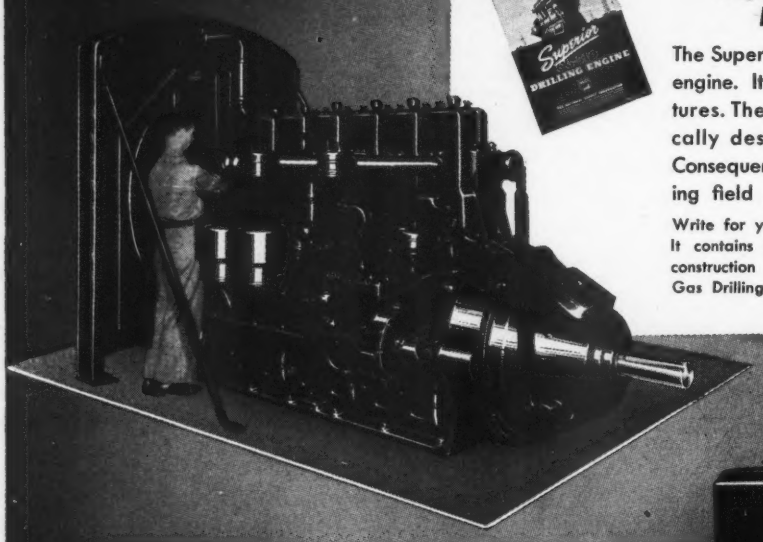
THERE SEEMS TO BE NO LIMITED returns to those who always credit others for achievement and success. Especially if the creditor is more responsible than the donor for good results. At this year's end the Kern Oil News department desires to share with contributors for news and names and places which were published and reported to some five thousand others in the span of 1946's calendar year. Thanks.

IN MANY ISSUES OF THE PAST we told you of our relentless regret to impart news of those who shuffled off this mortal coil. But news is news, and sometimes old copy is worth respect. And so by now the passing of Alfred Harrel, Kern's beloved first citizen, publisher and editor of the Californian, is already known to you. In paying our respects we simply want to say that the entire state of California in its bereavement will never forget his influence for every good.

Superior DRILLING ENGINES

6G-510 GAS . . . PTD DIESEL

Dependable, full capacity horsepower



Superior 6G-510 Gas Drilling Engine

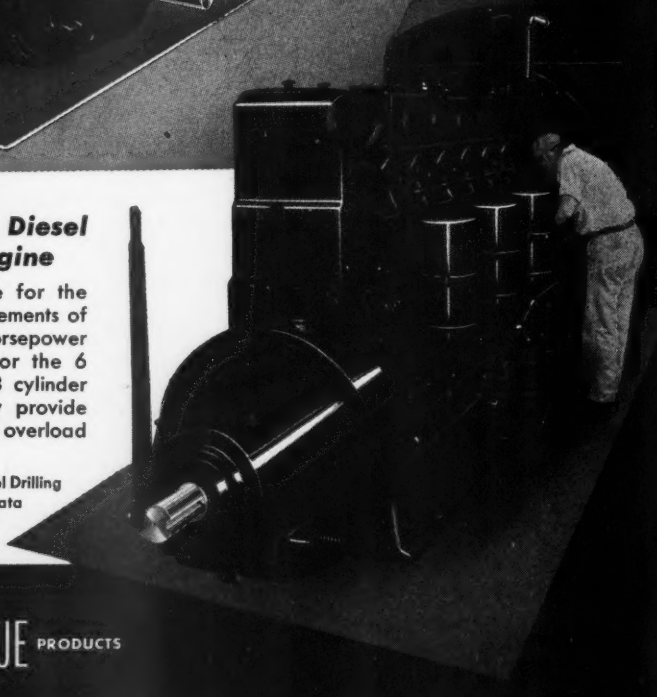
The Superior 6G-510 is a tough, strong engine. It has many distinctive features. The 6G-510 has been specifically designed for drilling service. Consequently, it is providing outstanding field service wherever it is used.

Write for your free copy of Bulletin No. 315. It contains complete engineering data and construction details of the Superior 6G-510 Gas Drilling Engine.

Superior PTD Diesel Drilling Engine

A modern engine for the heavy duty requirements of oil field service. Horsepower ratings of 260 for the 6 cylinder model and 355 for the 8 cylinder model are very conservative. They provide ample reserve power for occasional overload or sudden emergency.

Write for your free copy of "Superior PTD Diesel Drilling Engine." It contains complete engineering data and construction details of this tough engine.



First in Quality NATIONAL BLUE PRODUCTS

THE NATIONAL SUPPLY COMPANY

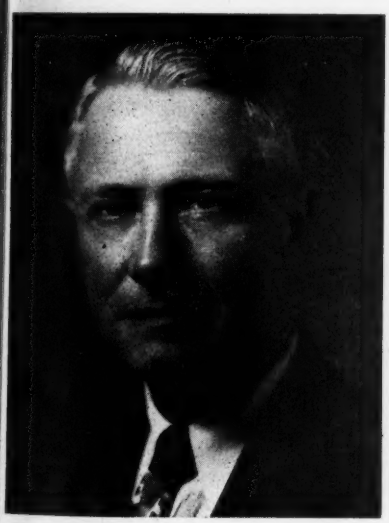
GENERAL SALES OFFICES: TOLEDO, OHIO · DIVISION OFFICES: DENVER · FORT WORTH
PITTSBURGH · TULSA · TORRANCE · EXPORT: NATIONAL SUPPLY EXPORT CORPORATION,
30 ROCKEFELLER PLAZA, NEW YORK, N.Y., U.S.A. · RIVER PLATE HOUSE, 12 SOUTH PLACE, LONDON, E.C.2.

Personalities IN THE NEWS

Allen Succeeds Collom at Continental

Charles R. Allen, formerly proration engineer for Continental Oil Company, Ponca City, has been appointed California region manager of the company's production department, with headquarters in Los Angeles, it was announced on December 3rd by President Dan Moran.

This appointment follows the retirement of R. E. Collom, vice president, who has been in charge of Continental's California production operations for the past 15 years, and who retired December 1 under the company's annuity plan. Mr. Collom will continue, however to serve as the company's director of the important Kettleman North Dome Association.



Charles R. Allen

A native Californian, Charley Allen has been on Continental Oil Company's production staff for more than 23 years. Born at Oakland, he attended school there and served as an army captain during World War I. After a few years with another oil company he joined Continental in 1923. Since then he has served the production department in supervisory positions at Tulsa, Oklahoma; Edmonton, Alberta, Canada; Fort Collins, Colorado; Hobbs, New Mexico; Evansville, Indiana, and on March 1, 1946, was named proration engineer.

Roy Collom is well known to the oil industry throughout the United States, having served the industry for more than 30 years.

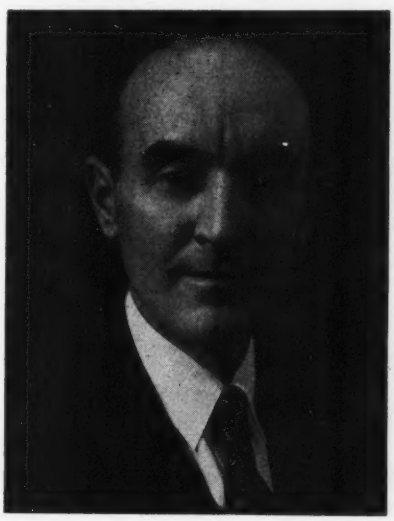
Spending his boyhood in Golden and Denver, Colorado, Roy Collom attended the Colorado School of Mines for two years, was graduated from Stanford University as a mining engineer in 1906. After college, his first job took him to the Nevada desert where he spent 18 months making a mining survey. After a period of employment for the Vandium Alloys Company in southern Colorado, Collom started his career in the oil business by going to work in the Coalinga, California oil fields for the Esperanza Oil & Gas Company. He was successively employed by the Oil Producers Agency, and the Producers Transportation Company, pipeline subsidiary of the Union Oil & Gas Company, and in October 1915, joined the California State Mining Bureau as petroleum engineer at Taft, California. He later became deputy supervisor of the State Oil & Gas Mining Bureau, and then chief deputy. A year later he joined the United States Bureau of Mines as petroleum technologist, and in another year returned to California as state oil and gas supervisor. In 1923, Mr. Collom was employed by the Coast Land Company, Los Angeles, a subsidiary of the former Marland Oil Company, as chief geologist, and at the time of the Continental-Marland merger in 1929, he was executive vice president of the Marland Oil Company of California.

Following the merger, Mr. Collom became manager of the California division of Continental Oil Company, and was named assistant to the president in December 1932, succeeding to his position as vice president in May, 1934.

Watson Advanced by Shell Chemical

Appointment of John W. Watson as vice-president and treasurer of Shell Chemical Corporation, effective January 1, was announced recently by J. Oostermeyer, president.

Watson is a former San Franciscan, having been a member of the local staff of a national auditing firm from 1919 to 1930. He started with Shell in St. Louis in 1930 as assistant comptroller, later moving to New York as treasurer. In 1944 Watson joined Shell Chemical in San Francisco as treasurer.



John W. Watson

In his new position he will continue to manage the Corporation's financial affairs.

A business visitor in Los Angeles in recent weeks was Jasper W. Tully, president of Reserve Oil and Gas Co. in San Francisco.

Campbell and Brown Advanced by Detroit Diesel

The appointment of John C. Campbell as Manager of Industrial Engine Sales and of James W. Brown as Advertising Manager was announced recently by V. C. Genn, General Sales Manager for the Detroit Diesel Engine Division of General Motors. The appointments were made by Mr. Genn at a sales conference held recently in Detroit where plans were laid for activities during 1947.

J. C. Campbell

Mr. Campbell, who will now direct industrial sales of the GM Series 71 Diesel engine through Detroit Diesel's distributors and dealers, brings to his new job a wide experience in many phases of the business. Following his graduation from the University of Detroit with an engineering degree, he spent several years with the Wright Austin Company and with the Frigidaire Division of General Motors. He joined Detroit Diesel in 1942 as a member of the Sales Department studying the wide uses of the GM Series 71 engine in industrial applications. Since 1945, Mr. Campbell has been in charge of Advertising and Sales Promotion activities for the company.

J. W. Brown

Mr. Brown, who now takes over as Advertising Manager, has been directly connected with advertising and publication work since his graduation from Yale in 1927. He spent several years on the advertising staffs of leading publications in Cleveland, Memphis, and Dallas, and for the past year has held the position of Product News Manager for Detroit Diesel. Mr. Brown, who is well known as the author of "What Do GM Diesels Do?", will continue to be in charge of Product News for the company.

West coast companies of Dresser Industries, Inc., were well represented at the Annual Sales and Engineering Conference held recently at the Edgewater Beach Hotel, Chicago.

Shown with J. B. O'Connor, Executive Vice-President of Dresser Industries, who forecast substantial expansion in the fields of oil and gas equipment, are (left to right) Robert M. Cook, Vice-President of Security Engineering Co., Inc., Whittier, Calif.; Clarence J. Coberly, President and General Manager of Kobe, Inc., Huntington Park, Calif., O'Connor; Otto Hammer, President of Security Engineering; and John D. McEwen, Vice-President and General Manager of the California Division of International Derrick & Equipment Co., located at Torrance, Calif.

Harry F. Sinclair, Sinclair Oil Co. in New York, and chairman of the board of Richfield Oil Corp.; Joe Pogue, vice president of Chase National Bank of New York, who is interested in the Anglo-American oil arrangement; and J. A. Jamison, director of Anglo-Iranian Oil Co., Ltd., were guests honored at the annual party of the wildcat committee of the Western Oil and Gas Association at the Los Angeles Biltmore Bowl.

Election of J. G. Stephens as vice president, treasurer and member of the board of directors of Douglas Oil Co. has been announced by W. G. Krieger, president. Stephens recently resigned as a vice president of the Bank of America, Los Angeles main office, where he had served for 25 years.

A. C. (Bert) Mattei, president of Honolulu Oil Corp., is a member of the recently organized National Oil and Gas Committee, designed particularly to keep abreast of developments concerning the natural gas act and the natural gas investigation conducted by the Federal Power Commission.

New World's Depth Record 14,601 ft.

set with a SHAFFER INSIDE CUTTER!

Shaffer-Hamon Releasing Socket Also Plays Prominent Role

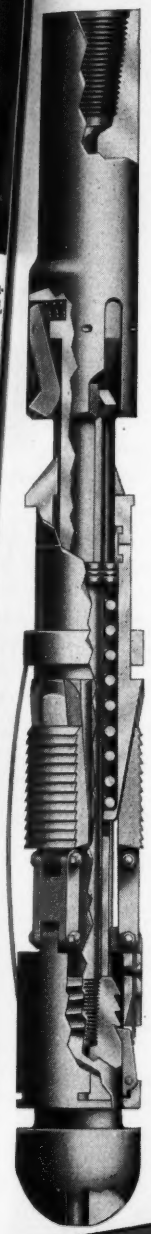
IN what is believed to be the world's deepest successful cutting job, a Shaffer Inside Cutter recently cut through a string of 3½" Grade "D" drill pipe at a depth of 14,601 feet, in a well at Long Beach, Calif.

Not only the extreme depth of this cutting job, but also the difficult conditions under which the cut was made indicate the all-around dependability of Shaffer Fishing Tools.

The fish consisted of over 12,000 feet of drill pipe which had parted while coming out of the hole and had fallen back to bottom, causing portions of the fish to be badly kinked. After several unsuccessful attempts had been made to pull the fish it was finally decided to attempt recovery by taking hold of it with a fishing string equipped with a Shaffer-Hamon Releasing Socket and then lowering a 2¼" O. D. Shaffer Inside Cutter through this fishing string and the fish to cut the pipe at the lowest point possible.

The Shaffer Inside Cutter was run in on a string of 1.66 inch O.D. Upset Tubing and the first cut made at a depth of 14,730 feet. However, after taking a pull of 280,000 lbs. and applying high pressure through the fish with the pump, the fish still could not be loosened for recovery. Since the unusually high pressure—in excess of 4,000 lbs.—had damaged the packer in the Releasing Socket it was then decided to release the Socket for packer replacement and make another cutting attempt higher up on the string.

It is interesting to note that in spite of the tremendous pull that had been taken with the tool, the Shaffer Socket readily released from the fish when desired *without the use of a bumper sub.* No bumper sub could be run on this fishing job because of the limited I. D. through which the cutting string had to pass.



Shaffer Inside Cutter

After renewing the packer, the Socket string was again connected to the fish, the cutting string lowered through it and a second cut was made at a depth of 14,601 feet. This time the Socket packer successfully withstood a pump pressure of 5,000 lbs. which was applied trying to break circulation. Although even this extremely high pressure would not break circulation, continued working of the fish finally loosened it at the 14,601 foot cut and all the pipe above this point was recovered with the Shaffer-Hamon Releasing Socket.

Another Example of Shaffer Dependability

Note that the first cut on this job was made at a depth of 14,730 feet and the second at a depth of 14,601 feet—both record-breaking depths. Yet in spite of the kinked condition of the fish and the extremely limited clearances through which the job had to be performed, at both of these extreme depths the Cutter performed perfectly—the second cut being necessary only because the damaged condition of the fish prevented recovery at the lower cut. *This job is another example of the rugged dependability of Shaffer fishing tools—at any depth, on any type of job!*

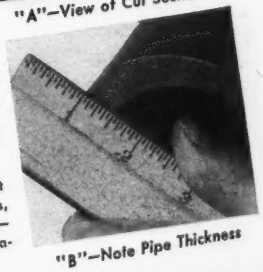
DOUBLE PROOF of Shaffer Dependability!

In Belridge Area—Cut Made at 13,765 Ft. through alloy steel drill pipe almost ½" thick!

Shortly after the above record-breaking cut was made, another Shaffer Inside Cutter was used in a well in California's Belridge area to cut through a string of 3½" 15.5 lb. Grade D drill pipe. With the Cutter run in on a string of 1¼" upset tubing, the cut was successfully made at the great depth of 13,765 ft.—through tough alloy steel almost ½" thick.

"A"—View of Cut Section

The accompanying photograph "A" shows the actual cut section. Note smooth, clean cut—proof of Shaffer's efficient, chatter-free cutting action. Also note in photo "B" the unusually thick wall through which the tool had to cut—almost a ½" of solid alloy steel.



"B"—Note Pipe Thickness

These two deep cuts—both made in different fields and under different operating conditions, but both made with a Shaffer Inside Cutter—are further proof of the all-around dependability you get in Shaffer Fishing Tools.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
CASPER, WYOMING, Mountain Sales and Service, 133 North Walcott Street
EXPORT SALES OFFICE: Shaffer Tool Works, 30 Rockefeller Plaza, New York, N. Y., U.S.A.

The above equipment is only typical of the complete line of Shaffer Fishing Tools available 24 hours a day—every day in the year—from Shaffer's conveniently located plants.

See the Shaffer Section—pages 3454 to 3505 of the new Composite Catalog.

Send for the new 1947 Shaffer Catalog for the latest information on the complete Shaffer line.

Lane-Wells Announce Personnel Changes

Morton T. Higgs, formerly Gulf Coast Division Manager of Lane-Wells Company for the past eight years, has been appointed to the newly created position of Manager of Field Operations and will make his headquarters in Los Angeles, according to Rodney S. Durkee, president. This new post has been made necessary by the tremendous growth of the company's business in recent years. The field activities of the three Lane-Wells divisions and forty field branches in principal oil areas will be closely coordinated under Mr. Higgs to render maximum service.

Morton T. Higgs

Higgs has had a wealth of experience with leading oil companies and oilfield service organizations in many parts of the world. Prior to joining Lane-Wells, he was division manager for eight years of Sperry Sun Well Surveying Company in Texas, Oklahoma and Kansas. His experience as a geologist includes work with large companies in Texas, Oklahoma, Kansas, Panama, Ecuador, Santa Domingo and West Indies. During World War I, he was in the U. S. Army and received a captain's commission in the Field Artillery Reserve when he was discharged.

John J. Neale, formerly Gulf Coast Division Sales Manager, has been advanced to the post of Gulf Coast Division Manager. In ten years with Lane-Wells, he has served as loader, rigman, gun perforator operator, sub-district superintendent and division sales manager. He previously had six years experience with the Texas Pipe Line Company.

John J. Neale

C. F. Ludwig formerly Assistant Division Operating Superintendent, succeeds Neale as Division Sales Manager.

H. W. (Pat) Hillebrandt, formerly District Operating Superintendent at Shreveport, succeeds Ludwig.

K. K. (Shorty) Gage, formerly Assistant Operating Superintendent at Shreveport, succeeds Hillebrandt. H. W. Greene, formerly Sub-District Superintendent at Lake Charles, succeeds Gage.

Dan H. McLendon has been appointed Sub-District Superintendent at Lake Charles. O. J. Guseman has been made Assistant District Superintendent at Houston.

C. R. Searcy has returned to the engineering department in Houston and Tom W. Lindsey is the new Sub-District Superintendent at Victoria.

Jack Oliffe, office manager for Suray Oil Corp. at Santa Maria, has returned to his duties up north, following a visit with his mother in Los Angeles.

Aline Barnsdall, oil heiress, left a estate estimated as worth $8,000,00 Miss Barnsdall died of a heart at tack at her home on a slope of Oliv Hill, just outside the 10 acres she gave the city of Los Angeles for Barnsdall Park. She was known best for her philanthropic activities and as a patron of the arts.

Thomas W. Simmons, president of Bolsa Chica Oil Corp., held forth at his vast and beautiful Suzy-Q Ranch during the holiday season. Tom, in addition to his oil interests, guides the Hollywood Turf Club. He has a string of race horses in training on the ranch.

The tragic aftermath to the war in Holland is portrayed in a letter from Mrs. W. van Amerbeek of The Hague to Mrs. John D. Savage, wife of an exploitation engineer for Shell Oil Co. in the Los Angeles Basin production division.

Mrs. Savage was the donor of half-a-dozen pairs of rayon stockings to the clothing collection made recently by the Long Beach office for Netherland relief and Mrs. van Amerbeek happened to be the recipient.

"My mother," the letter reads, "sisters and I wish to thank you very much for the stockings. You can't imagine how awfully happy we are with them, for it has been such a long time since we have had any stockings at all, and it is already rather cold here; they are such beautiful ones. Perhaps after many years we will have them here again. We need so many things after that terrible war. Things are getting better and better and we are very grateful for everything that people in other countries have done for us."

Oil men listed as members of the Los Angeles Turf Club include Harold Pauley, Edgar S. Dulin, Loren L. Hillman, and W. H. and E. L. Doheny, III. The club opened Santa Anita's tenth annual winter season on December 28, with the oil fraternity well represented.

With Drilling Contractors

"Rumors Are Flying," to paraphrase the title of a popular song, that major purchasing companies are prepared to follow the action of other states and boost prices of crude oil 10 cents a barrel.

Rumor has it that the increase will be announced in either the first or second week of January of the New Year. If the hike should come about, a marked increase in new drilling is expected with an important and consequential benefit probably redounding to the contract drilling branch of the petroleum industry.

Although exploratory operations in the state during 1946 fell below the preceding year, all signs point to a bright and prosperous year ahead. New reserves must be found if California is to maintain her position in the nation's oil picture. Extensive prospecting, therefore, is mandatory and is recognized as such by all branches of the industry.

Santa Maria Drilling Co. of Long Beach, formerly known as Kern Drilling Co., has been awarded contract by the Far East Development Co., Inc., for oil well drilling on the Philippine Islands.

This was announced the other day by Colonel Andres Soriano, president of the Far East Company. He disclosed that oil exploration on the islands was nearing resumption, after a long interruption caused by the Japanese invasion.

The first tests drilled will be on a promising structure on the Island of Cebu. Exploratory work in other areas will follow in due order.

The contractor has made the necessary arrangements for shipping from the United States heavy-duty rotary and other drilling equipment early in 1947.

Dunlap & Graham of Long Beach (Dan Dunlap and Doug Graham) are about to complete another good producer in the West Newport Beach area. The well in question is Atha No. 4 in the Atha area, sponsored by Hiawatha Exploration Co. The contractor also has strings going at Huntington Beach, Seal Beach, Torrance and in a number of other areas.

Clyde Hall has the contract to drill a well for California Exploration Co. at Edison. The East San Emidio Oil Land Co. test in the Arvin area will be drilled by Barnes and Shadrick. Severns Drilling Co., which drilled under contract the discovery well in the Gardena area, is in charge of drilling British-American Oil Prod. Co.'s Alondra Park No. 1 and Bodger No. 2 in the Los Angeles suburb.

Three tests in the Castaic area are contract jobs. Barnsdall Oil Co.'s Dodge No. 1 is going ahead under the guidance of Camay Drilling Co., Republic Operator, Inc., Fee No. 1 is a Richard & Rowan job. T. P. Pike Drilling Co. has the contract on Universal Consolidated Oil Co.'s Devils Canyon No. 1. All three projects seek to confirm or disprove a theory long held that the area under scrutiny is commercial oil ground.

The recent visit of the nation's contract drillers to Eastern pipe mills was accentuated by a request for greater attention to drill pipe inspection at the mill, J. E. Warren, president of the American Association of Oilwell Drilling Contractors, reported. A small additional expenditure might result in elimination of some operating trouble, he said.

The association executive stated that representatives of the various pipe mills pledged their support of any reasonable inspection method. They stated, however, that methods now used appeared fairly satisfactory to them. Contractors in the visiting party agreed in asking even greater care in the inspection department of mill.

California contractors working for the Arabian American Oil Co., an affiliate of Standard Oil Co. of California, in the oil fields of Saudi Arabia, find life goes as much the same as at home. Standard's regular bulletin describes wholly new towns built by the company at main points of operation to house Americans.

California-type bungalows are air-conditioned. American food is imported from home. Children attend American schools. Electricity, gas, telephones, automobiles, radio, hospital service, soda fountains, swimming pools, flower gardens, children's playgrounds and facilities for tennis, bowling and softball are provided.

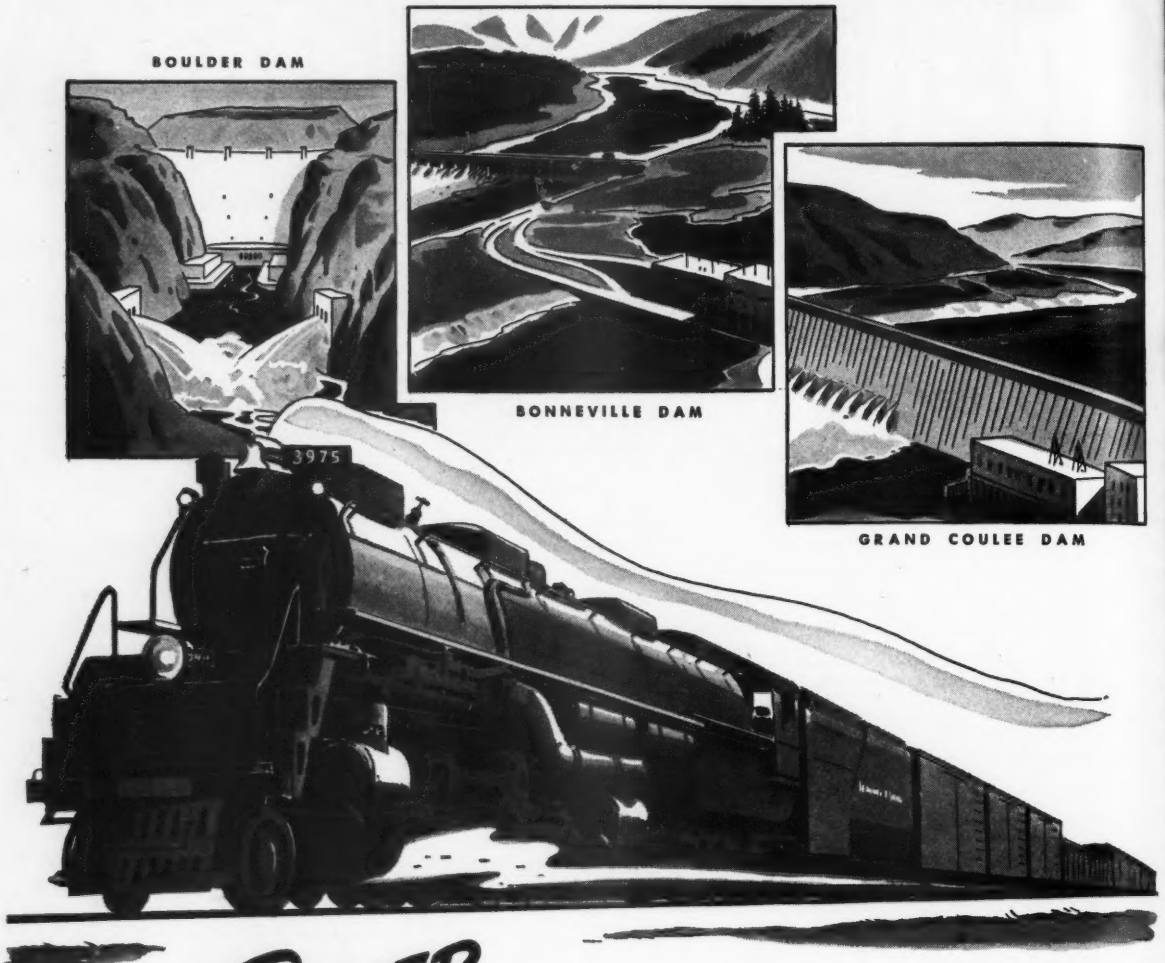
One of the most closely watched wildcat tests in the state is Standard Oil Co.'s project in the Middle Dome area of Kettleman Hills. Rocky Mountain Drilling Co. has done an enviable job in carrying the well down to present depth of 12,317 ft. At last reports Rocky Mountain was reaming for a formation test and indications are that the well may have uncovered something of interest in the objective Eocene.

A monumental fishing job, several thousand feet higher in the hole, was completely mastered by the contractor in a surprisingly short time.

The drilling program mapped out by the new Adams Oil Co. for the Edna-Arroyo Grande area will be in charge of Camay Drilling Co., which has strings going at Ramona, Los Alamos and in other oil sectors.

Camay's operations on the Hawa-

A MESSAGE TO THE PETROLEUM INDUSTRY

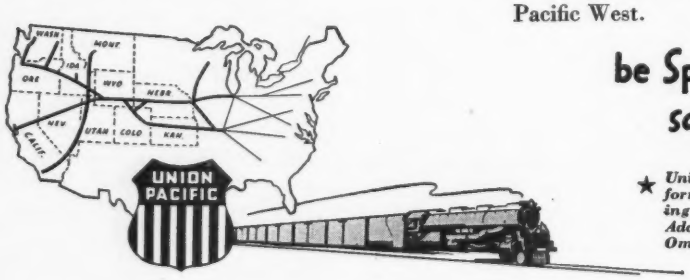


More POWER to You

Three great dams, harnessing the natural force of the Colorado and Columbia Rivers, provide tremendous industrial power.

Union Pacific freight locomotives provide industrial transportation power over the Strategic Middle Route.

Power, light, and efficient transportation . . . combined with a wealth of raw materials and adequate "growing space" . . . offer unusual opportunities for industry in the Union Pacific West.



be Specific – say "Union Pacific"

★ *Union Pacific will gladly furnish confidential information regarding available industrial sites having trackage facilities in the territory it serves. Address Industrial Dept., Union Pacific Railroad, Omaha 2, Nebraska.*

UNION PACIFIC RAILROAD

The Strategic Middle Route

an Islands are not looking for oil, ut for needed water supplies. The ompany has been no less success- l in the "Pearl of the Pacific" area s in the United States.

Hayes & Sprague apparently have betted a new discovery in drilling eaboard Oil Co., Mission Land No. in the Newhall area. The con- ractor is rigging to pump.

Standard Again Drills in Washington

Standard of California announced hat work has begun on its western Washington exploratory well lo- ated in the vicinity of Martha Lake, ight miles northeast of Edmonds. The site is now being cleared pre- aratory to moving in drilling equip- ment.

The well, known as Alderwood No. 1, is located in Section 35, Township 28N, Range 4E. Selection f the site was based on a series of eismograph tests conducted by the Company during the past year.

The plan for drilling in this area was first announced by H. D. Col- er, Chairman of the Board, during recent visit to Seattle.

This will be the third attempt by Standard to discover oil or gas in he State of Washington. In 1920 he Company drilled a dry hole in he Moclips area near Aberdeen. Its econd venture in Whatcom County was abandoned early this year.

Bankline Scores in Ramona Field

Bankline Oil Co. has chalked up nother well in the Ramona field. Its atest prodfucer is Black No. 106, which came in from a plugged depth of 4041 ft. for 220 barrels of 23 gravity oil a day. Location is in Sec. 13-4n-18w. No. 105 is a foun- dation.

Southern California Pet. Corp., Ltd., Adams-Aguirre No. 103 in Sec. 13 is down 4712 ft. in hard fine oil sand. The top of the oil zone is placed at 3490 ft.

The Texas Co. is rigging derricks or Kern No. 13 and No. 14 in Sec. 18.

WAX -

FINE IN CANDLES
A HEADACHE IN OIL LINES

Nobs Wax Solvent will dissolve and remove the most persistent waxes and paraffines from wells lines and traps.

NOBS DEHYDRATING CORPORATION
2465 East 53rd Street, Los Angeles 11, California

Shell Test Well Drilled with Horizontal Drain Holes

(Continued from Page 27)

it possible to use smaller pipe, which can be handled with light portable equipment. In this respect, conditions are simliar to well servicing operations.

"Costs can also be reduced by adopting a program calling for the drilling of drain holes in a number of wells. It then becomes profitable to use the best suitable equipment to complete all the jobs. In 'new' wells, drain holes can be furnished at a fraction of the cost involved in 'old' wells, since no special rigging-up is required and the holes can be drilled within one or two days after completion of the main bore."

The new Adams Oil Co. is headed by Stephen W. Cunningham. Tyler F. (Bud) Woodward is vice president; John I. Anderson, treasurer; and Robert G. Bundy, secretary. These officers are also directors, as is Barkman C. McCabe.

Dave Kilgour of the Western Oil and Gas Association, the life of any party, was down to a whisper at the Christmas Jinks of the Wildcat Committee due to a sudden and severe attack of laryngitis. Despite the vocal handicap, Dave was no less in evidence in seeing that every one present had a good time.

Senator Josiah W. Bailey, 73, Democrat of North Carolina, who had completed plans to return to Washington for the new session beginning January 3, died suddenly at his home in Raleigh. He was chairman of the Senate Commerce Committee.

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FOR SALE

Two 125 h. p. 250# working pressure Broderick boilers Herley-Kelly, 3201 Pasadena Ave., Long Beach 7, Calif. Phone Long Beach 425-23. tf

FOR SALE—TANK FARM

2 acre tank farm, 4 miles from Long Beach, with 9 tanks; total capacity 14,750 bbls.; has 2 truck loading racks and loading rack on Southern Pacific spur. Price $13,000. Dutch Bandringa, Broker, 741 Compton Blvd., Clearwater, telephone MEtcalf 3-2910. tf

FOR SALE

5 Kewanee, 125 h.p. 300 lb. W. P. boilers, mounted on skids, equipped with Pinkerton water regulators, low water alarms, fire control and Sonner burners.
1—14½x7¼x20 G.D. slush pump.
3—14½x7¼x18 W.S. slush pumps.
3—14x7¼x14 G.D. slush pumps.
Cameron blowout preventer, 7" type M.R.-6.
3—Hughes Type J core barrels, 5¾" to 6¾".
1—3 section bailer, 5" O.D., 60 feet long.
1—Type B-6 Emsco swivel.
1—Type G.S. Ideal swivel.
2—Steam scrubbers.
2—8" and 3—9" Wigle hooks.
9—Reed reamers, 5⅞" up to 19½".
2—Pyle National Steam generators, 4½ K.W.
1—Ideal double deck crown.
ROCKY MOUNTAIN DRILLING COMPANY
437 S. Hill St., Los Angeles 13, Calif.
Phone: MIchigan 6215 12/20/b

California Oil World's Monthly Summary

DEVELOPMENT—PRODUCTION—SUPPLY & DEMAND
PACIFIC COAST TERRITORY
TABLE I—CALIFORNIA DEVELOPMENT—PRODUCTION

	OCTOBER, 1946 DEVELOPMENT				PRODUCTION	
	Active Drilling Wells	Oil Wells Completed	Initial Production B/D	Oil Wells Completed First 10 Months	Daily Average October 1946	Daily Average October 1945
SAN JOAQUIN VALLEY						
Ant Hill	1	1	84	9	1,407	772
Antelope Hills	.....	.....	.....	.....	1,491	1,699
Arvin	.....	.....	.....	.....	23	42
Bellevue	.....	.....	.....	.....	342	445
Belridge—North	.....	.....	.....	.....	4,988	5,771
Belridge—South	4	2	97	75	10,310	12,389
Blackwell's Corner	2	3	46	6	250	108
Buena Vista Hills	2	2	294	19	40,186	40,559
Burrel	.....	.....	.....	.....	12	14
Canal	.....	.....	.....	.....	2,332	2,980
Canfield-Gosford	.....	.....	.....	.....	61	163
Canfield Ranch	.....	.....	.....	.....	29	32
Coalinga—East	4	1	198	11	16,341	18,350
Coalinga—Nose	2	.....	.....	2	55,908	53,726
Coalinga—West	.....	1	26	3	6,668	7,611
Coles Levee—North	2	.....	.....	7	16,097	20,194
Coles Levee—South (Black Oil)	1	.....	.....	1	2,077	2,287
Cymric	12	12	1,065	84	10,880	.....
Edison	2	1	1,154	69	13,645	8,481
Elk Hills	5	1	191	15	8,343	14,588
Fruitvale	.....	.....	.....	.....	7,316	8,203
Greeley	.....	.....	.....	4	10,466	11,049
Helm	.....	.....	.....	23	4,341	3,405
Jacalitos	1	1	65	9	4,204	3,625
Kern Front	3	2	142	23	12,453	12,568
Kern River	4	3	34	18	9,956	9,358
Kettleman North Dome	4	.....	.....	18	38,016	37,710
Lanare	2	.....	.....	16	2,474	944
Lost Hills	5	8	378	25	3,623	3,161
McClung	.....	.....	.....	.....	10	39
McKittrick	.....	3	197	8	4,500	5,887
Midway-Sunset	2	1	61	19	35,646	38,090
Mountain View	2	4	1,707	14	5,015	2,594
Mount Poso	.....	.....	.....	14	15,431	17,577
Paloma (Black Oil)	12	2	1,297	18	6,923	3,333
Pleasant Valley	.....	.....	.....	2	3,437	3,658
Pyramid Hills	.....	.....	.....	1	295	370
Race Track	2	1	282	10	1,598	961
Raisin City	.....	.....	.....	5	3,018	2,881
Rio Bravo	.....	.....	.....	.....	12,937	13,189
Riverdale	.....	.....	.....	7	4,281	3,758
Rosedale Ranch	.....	.....	.....	.....	143	126
Round Mountain	3	2	141	8	8,763	9,266
Salt Creek	1	3	906	12	2,311	.....
Santiago	.....	1	840	22	6,304	818
Sheep Springs	.....	.....	.....	3	447	571
Strand—East	.....	.....	.....	.....	558	596
Strand—West	.....	.....	.....	.....	1,666	1,635
Tejon	2	5	594	35	1,889	468
Ten Section	1	.....	.....	.....	9,000	8,444
Union Avenue	.....	.....	.....	.....	375	86
Wasco	.....	.....	.....	.....	667	1,136
Wheeler Ridge	.....	.....	.....	.....	232	234
Miscellaneous	.....	1	68	4	94	46
TOTAL SAN JOAQUIN VALLEY	81	61	9,867	619	409,779	395,997
COASTAL AREA						
Aliso Canyon	2	1	121	7	3,025	2,919
Capitan	.....	.....	.....	6	3,379	75
Del Valle	.....	.....	.....	3	4,731	5,357
Elwood	1	.....	.....	7	7,178	6,183
Gato Ridge	1	.....	.....	4	3,732	4,158
Newhall-Potrero	2	1	374	8	5,933	5,563
Oak Canyon	.....	.....	.....	1	1,665	1,901
Oxnard	1	.....	.....	.....	653	1,316
Padre Canyon	1	.....	.....	2	2,353	2,207
Ramona	6	5	470	24	1,908	256
Rincon	1	.....	.....	.....	4,177	4,407

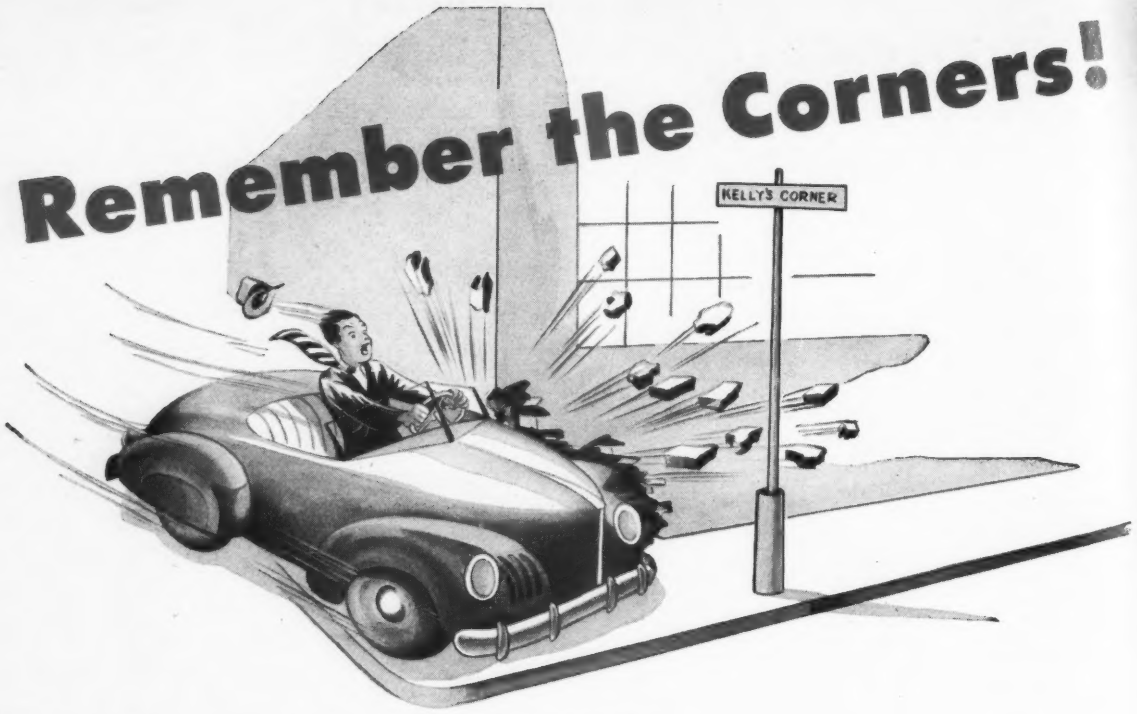
	OCTOBER, 1946 DEVELOPMENT				PRODUCTION	
	Active Drilling Wells	Oil Wells Completed	Initial Production B/D	Oil Wells Completed First 10 Months	Daily Average October 1946	Daily Average October 1945
MONTHLY SUMMARY—Continued						
San Miguelito	3	.....	.....	6	5,077	4,729
Santa Barbara	.....	.....	.....	.....	72	105
Santa Maria	10	7	1,289	24	13,520	12,244
Santa Maria Valley	6	.....	.....	37	30,180	33,936
Ventura Avenue	8	3	1,673	35	44,903	43,814
Ventura-Newhall	7	2	505	21	7,666	6,188
Watsonville	.....	.....	.....	.....	.....	25
Zaca Creek	.....	.....	.....	.....	303	239
Miscellaneous	.....	.....	.....	.....	.....	.....
TOTAL COASTAL BASIN	49	19	4,432	185	140,455	135,622
LOS ANGELES BASIN						
Alondra	2	.....	.....	1	546	.....
Brea-Olinda	2	1	102	6	11,084	10,793
Buena Park	.....	.....	.....	2	68	84
Coyote—East	1	1	540	8	4,898	4,845
Coyote—West	3	1	25	8	14,959	15,806
Dominguez	3	1	51	9	15,323	15,864
East Los Angeles	1	.....	.....	4	713	.....
El Segundo	.....	.....	.....	1	523	744
Huntington Beach	6	5	1,312	41	46,517	45,915
Inglewood	.....	.....	.....	.....	12,637	14,806
La Mirada	1	.....	.....	1	35	.....
Lawndale	.....	.....	.....	.....	19	16
Leffingwell	.....	.....	.....	1	49	.....
Long Beach	.....	.....	.....	1	24,174	25,054
Los Angeles-Salt Lake	.....	.....	.....	.....	492	513
Montebello	.....	.....	.....	2	8,157	9,657
Newport-Costa Mesa	8	6	690	56	6,310	2,232
Playa Del Rey	.....	.....	.....	.....	2,248	2,226
Potrero	.....	1	500	2	838	1,097
Richfield	1	.....	.....	6	7,289	7,163
Rosecrans	.....	.....	.....	3	5,000	5,088
Sansinena	.....	.....	.....	.....	73	122
Santa Fe Springs	.....	.....	.....	.....	16,747	15,278
Seal Beach	3	.....	.....	16	10,355	9,614
Torrance	1	.....	.....	16	8,369	9,088
Turnbull Canyon	.....	.....	.....	.....	119	156
Whittier	.....	.....	.....	.....	1,051	976
Wilmington	22	11	3,049	155	116,737	98,764
Yorba Linda	.....	.....	.....	.....	.....	.....
Miscellaneous	1	.....	.....	.....	137	.....
TOTAL LOS ANGELES BASIN	55	27	6,269	339	315,467	295,901
EXPLORATORY						
Outpost Wells	28	.....	.....	.....	.....	.....
Wildcats	19	.....	.....	.....	.....	.....
Gas Wells	3	4	.....	59	.....	.....
TOTAL CALIFORNIA	235	111	20,568	1,475*	865,701	827,520

*—Includes gas wells completed and 273 wells abandoned.

TABLE II—SUPPLY AND DEMAND FOR PETROLEUM PRODUCTS
PACIFIC COAST TERRITORY
DATA FOR OCTOBER OF EACH YEAR

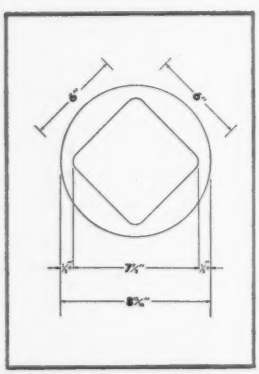
	October 1941	October 1942	October 1943	October 1944	October 1945	October 1946
RAW MATERIAL—B/D						
1. Crude Oil Produced—California	651,194	723,313	786,387	880,351	827,520	866,250
2. Crude Oil from outside 5 Western States	1,903	3,945	5,162	4,262	3,222	4,235
3. Natural Gasoline Produced	38,000	36,000	39,000	41,000	40,000	42,000
SUPPLY OF FINISHED PRODUCTS						
ALL SOURCES—B/D						
4. Natural Gas., L.P.G. and Condensate	3,516	2,484	7,710	16,808	14,839	11,484
5. Gasoline and Naphtha Distillates	260,097	263,903	272,355	319,903	296,129	329,806
6. Kerosene and Kerosene Distillates	(2,032)	6,903	9,742	7,677	9,516	7,451
7. Lubricating Oils, etc.	13,807	11,194	14,452	13,710	12,290	12,839
8. Gas Oil and Diesel Oil	68,516	76,129	81,612	87,839	66,903	123,032
9. Fuel Oil Residuum	300,226	366,387	393,387	446,710	416,742	361,710
10. Asphalt and Road Oils	35,161	41,097	31,516	29,194	24,807	29,097
11. Coke and Other Finished Products	4,032	1,387	1,677	3,903	613	6,710
12. Other Unfinished Oils	(6,613)	(226)	(4,935)	(419)	(387)	(1,420)
13. Refinery Shortage and Gas	24,032	30,257	39,614	44,163	36,870	32,615
14. Crude Oil (Net)	(129)	(24,677)	11,549	(10,774)	17,774	29,064
15. TOTAL SUPPLY	700,613	774,838	858,679	958,714	896,096	942,388
16. TOTAL DEMAND	704,033	811,257	987,420	944,777	897,160	870,421
17. DIFFERENCE	(3,420)	(36,419)	128,741	13,937	(1,064)	71,967
18. Stocks on hand End of each month (Total Bbls.)	142,164,000	130,504,000	110,677,000	93,555,000	76,503,000	89,809,000

Remember the Corners!



NO DRIVER CUTS A CORNER unless his car whips out of control. No Kelly corner dashes holes in casing unless it is allowed to whip. Both accidents occur because someone forgot how far corners stick out.

Operators using Patterson-Ballagh Kelly sub Stabilizers to control the whip of their Kellys have saved many thousands of dollars in potential casing and grief stem trouble. They *remember the corners* when selecting the correct sub Stablizer to fit their particular Kelly and casing combination.



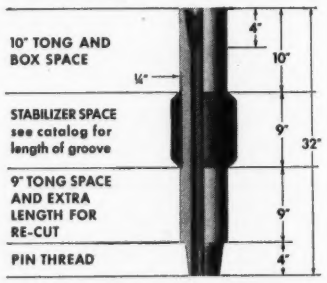
Installation dimensions of a Stabilizer, Code: MIMOSA.

"REMEMBER THE CORNERS" for complete protection. Every Kelly corner should always be protected by at least ½ inch of rubber. For example, the greatest diagonal distance between the corners of a 6 inch square Kelly is 7⅞ inches. This requires a Stabilizer 8⅞" O.D. when installed to give ½ inch of rubber protection on opposite corners. The Patterson-Ballagh Stabilizer, code: MIMOSA, having an 8 15/16" installed O.D. would be recommended in this case, assuming that the Kelly sub has a diameter of 7¾" and is grooved to 7¼".

Always use a Stabilizer with at least 1 inch greater installed O.D. than the longest diagonal dimension across the corners.

SECTIONAL VIEW OF KELLY SUB WITH PATTERSON-BALLAGH STABILIZER

SUGGESTED MINIMUM DIMENSIONS FOR KELLY SUB AND ALLOWANCES FOR TONGS AND THREADS.



LEAVE ROOM ON EACH SIDE OF STABILIZER GROOVE FOR TONGS, AND RE-CUT OF THREADS.

The drawing above shows suggested minimum dimensions for Kelly sub Stabilizer installations. Patterson-Ballagh engineers have designed, specified, and coded Stabilizers and Protectors for over 700 possible combinations of Kelly and casing sizes now in use. Your Patterson-Ballagh man will give you complete information for getting the *longest wear and best results in your set up*. Proper Kelly stabilization pays big dividends.

Specify

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SAN FRANCISCO 4

THIS LAUGH

OFF!!

Some people's minds are open like that of the woman who was heard to say as she started for a political meeting: "I am not prejudiced at all. I am going with a perfectly opened and unbiased mind to listen to what I am convinced is pure rubbish."

A little colored boy was sitting slumped down in a chair with his feet resting on top of the table, when his mammy came into the room and said, "Lord, yo' sho' is a lazy boy, youse zackly lak yo' pappy. Thank God I didn't marry that man."

Murphy's Landlady: "Pat, I'm afraid I shall have to charge you extra. You're such a big eater!"

Murphy: "For heaven's sake don't do that! I'm killin' myself already tryin' to eat what I'm payin' for now."

Many years ago, an emperor was surprised to see a slave passing his palace who was almost the image of himself.

"Ho, there," the emperor cried. "Slave, did your mother ever pass this way?"

"No, sire, but father did," was the rejoinder.

"Mama," said little Johnny, "don't men ever go to heaven?"

"Why, of course, dear. What makes you ask?"

"Because I never see any pictures of angels with whiskers."

"Well," said the mother thoughtfully, "some men do go to heaven, but they get there by a close shave."

The honeymoon had waned, the gilt had worn off the wedding and it was their first real quarrel, with each trying to get the last word.

"If I'd known what I know now," he said coldly, "I'd have walked as far as a pair of shoes would have carried me before I married you."

Eagerly she grabbed her chance. "And if I'd known," she snapped, "I'd have seen to it that you got a good pair."

She: "I don't think I look thirty, do you dear?"

He: "No, darling, not now, but you used to."

The Congressman's sister was accustomed to keeping an eye on him while at home. On this occasion she called him up at Washington by long distance.

"What have you been doing?" she demanded.

"What do you mean?"

"Don't try to fool me. I read the papers. Yesterday they said the Speaker didn't recognize you."

She was asking for a divorce. "Jedge" she declared, "my husband drinks like a fish."

"Well, Jedge, Ah do drink a little," the husband admitted. "Ah could say my wife drove me to it—but Ah'm not gonna run her down. All Ah say is that Ah pawned the kitchen stove and she didn't miss it for two weeks."

Both the tool dresser and his helper stuttered. The helper had finished heating the bit and placed it upon the anvil for the toolie to dress.

"H-h-hit it," he stuttered to his helper.

"W-wh-wh-wh-where?" asked the other.

"Aw, g-g-g-gosh, n-n-now, we'll ha-have to h-h-heat it again."

Money doesn't bring happiness. A man with ten million dollars is no happier than a man with nine million dollars.

Teacher: "Johnnie, do you want to leave the room?"

Johnnie: "You don't think I'm standing here hitch-hikin', do ya?"

Doctor: "Sambo, how is it that your family keeps so healthy?"

Sambo: "Well, suh, we's done bought us one of dem sanitary drinking cups and we all drinks outen it."

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HAPPIER NEW YEAR
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A. P. JOHNSTON

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Arizona "Wildcat" Will Spud In Soon

By Ray E. Colton, Sc.D.
Petroleum Geologist

At this writing, the Willcox area of Cochise County, southeastern Arizona, is "buzz' with excitement over the scheduled drilling of a test for oil on the Willcox Structure, located west of the town. This well which will try for "shallow pay" is being drilled for the Arizona-Cochise Petroleum Corporation by Coats and Foster, Drilling Contractors of Lubbock, Texas. The Arizona-Cochise Petroleum Corporation maintains field offices in Douglas, Willcox and Phoenix, Ariz., and the President of the Company is Mr. Loy Turbeville of Phoenix, Vice Preseident is Lee Fisher, Nogales, Ariz., Sam Watkins of El Paso, Texas is a Director and Lou Merrill of El Paso is Secretary.

Field geological work in selecting the site for this latest Arizona "wildcat" was done by Chuck Aston, Geologist of Artesia, New Mexico, and field microgrammatic work was done by McFarland and Cragg of Abilene, Tex.

If no production is obtained in the shallow strata at about 2,000 feet, drilling will be carried to deep potential "pay" zones. The derrick already erected is 126 feet, and it is of tubular steel, insuring protection against falling due to prevailing high winds of this area of southeastern Arizona.

The latest type drilling apparatus will be used in drilling this well, and several favorable geologic reports previousy rendered on the area, indictate the strong possibility of commercial "pay" in one of several horizons. Seeps of oil coming from the Southern Pacific Railroad Company's water well at Willcox Station, is another strong possibility that oil source beds exist in the area.

Capitan Test Squeezes Perfs

Having swabbed fresh water from the perforated interval of 1750-1800 ft. in Orella No. 1 in Sec. 31-5n-30w in the Capitan area, Rothschild Oil Co. is squeezing off perforations. A little gas accompanied swabbing operations.

Union Pacific Head Warns Operators of Gasoline Truck

Operators of highway gasoline distributing trucks who become involved in accidents resulting in damage to Union Pacific property will be made defendants in legal action, it was announced by George F. Ashby, president.

The second such accident resulting in the burning of a railroad bridge occurred a short time ago. The bridge, on the North Platte branch of the railroad, near Lisco, Nebraska, was completely destroyed when flaming gasoline from an overturned truck on the paralleling highway ran down a small wash and ignited the railroad structure.

The truck, driven by Gordon Brown, of Cheyenne, and owned by the Melton Transfer Company of Cheyenne, crashed into the abutment of the highway bridge, overturned and caught fire. The gasoline in the trailing tank poured into the gulley and ran down to the railroad bridge. Railroad tracks and the highway parallel each other at this point.

Recently a Union Pacific bridge over a highway at Devil's Slide in Ogden Canyon, Utah, was destroyed, when a gasoline truck on the highway crashed into an abutment of the overpass, caught fire and the burning gasoline destroyed the structure and tied up main line traffic for twelve hours, resulting in long detours and subsequent delays for both freight and transcontinental passenger trains.

"Such accidents are inexcusable," said Mr. Ashby, "and they only emphasize the extreme danger of allowing such traffic on highways which were constructed for and are used by the public, not to mention possible damage to other property, as indicated by the two accidents in which we have suffered in ten days."

The new standard exploratory venture in the Garden Grove area of Orange County is moving ahead under the guidance of T. P. Pike Drilling Co. Pike's recent job in the McKittrick area for the Texas Co. scored a new discovery. The well, known as West Pet No. 1, is shut in.

ENGINEERING LIBRARY

CALIFORNIA OIL WORLD

JAN 16 1947

Strength alone is important but it is only one of the features to expect in Manila rope. Uniformity, long-life and general expertness in manufacture—these too, have a bearing on the size of your buying dollar. You get all when you specify Great Western Manila rope.

All rope fibers are still in short supply—it's necessary to get that extra service from each length of rope you have.

Great Western Manila and Sisal rope is available at all stores of The Republic Supply Company of California, in the sizes of each fiber as CPA regulations permit.

The REPUBLIC SUPPLY COMPANY of California

LOS ANGELES AND OAKLAND

"Our Conditions Are Different"

Of course they are—no two wells ever drilled were just the same. But here's something to remember . . . a fact proven times without number in the Mid-Continent, on the Gulf Coast, in California, in *every* major oil area in this country . . . and that is,

under ANY Conditions, you can call your shots . . . and McCULLOUGH will put the shots where they count!

RUN ON DRILL PIPE

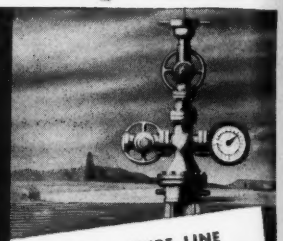
A method often used when well pressures are high and it is considered necessary to have absolute control at all times, before and after perforating.

ELECTRICAL FIRING

Gun run from completely equipped service truck, or on your own conductor cable. As in all McCullough gun-perforating jobs, all shots are fired at the same instant while the gun is at rest at the exact depth you want it. There are no electrical circuits in the gun, so it is only a matter of a few seconds to switch the electrical top assembly to another gun—no long waits between runs.

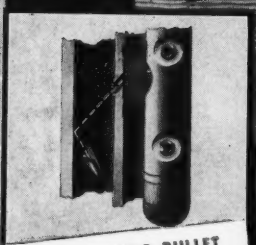
MECHANICAL FIRING

By using the mechanical firing top assembly all McCullough guns can be run on a wire line, either our own or your sandline or drilling line, and detonated by go-devils dropped when the gun is in place. Positive in action, perfectly safe, this method gives all the advantages of McCullough gun-perforating to a wide range of jobs under many different conditions.



RUN ON WIRE LINE

In extremely high-pressure wells, where blowout preventer packing is necessarily so tight that the weight of the gun cannot pull an ordinary line through it, or when there is danger of the large line being blown out, McCullough successfully perforates by running the required type of gun quickly and safely through a special packing head on a piano-wire measuring line—thin and smooth but tremendously strong.



THE DEFLECTING BULLET

For regulating gas/oil ratios, for freeing stuck pipe, for establishing circulation—for any job where it is necessary to punch a clean hole through drill pipe or tubing *without damaging the surrounding casing*, McCullough has developed an exclusive feature to do the "impossible" . . . the McCullough Deflecting Bullet. The "bullet which turns a corner" has been used in hundreds of jobs.

RUN ON TUBING

Using the same set-up as for drill-pipe, or with the addition of a packer between slotted pipe and the production string, high-pressure wells are successfully perforated with a McCullough regular type or sectional gun firing as many shots as are needed to cover the productive zones.

McCULLOUGH SERVICE LOCATIONS

23

McCULLOUGH TOOL COMPANY: 5820 S. Alameda St., Los Angeles 11, Cal. Export Office: 30 Rockefeller Plaza, New York 20, N. Y.

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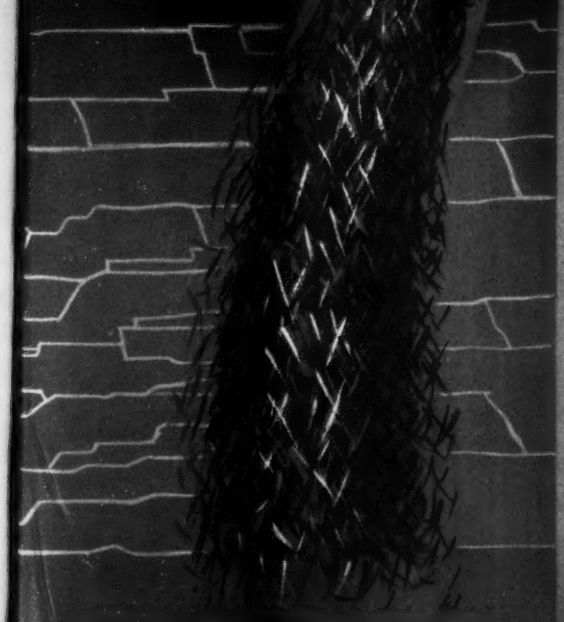
CONTROL CIRCULATION MUD LOSSES WITH Palco TRADE MARK Seal



The success of PALCO SEAL in preventing and restoring lost circulation is based on a solid foundation of performance... PALCO SEAL is a fibrous material derived from age-old California Redwoods from which it inherits its resistance to rot and decay... The fibres mix readily with the drilling mud, are easily pumped through average bit water courses, float shoes, etc., and stay in suspension until deposited in fissures, cracks and porous strata... There they mat into a dense, cross-hatched seal which effectively closes off thief formations... PALCO SEAL comes in compressed bales weighing 100 pounds... Liberal samples are available for test purposes... Ask your nearest Halliburton field representative for details.

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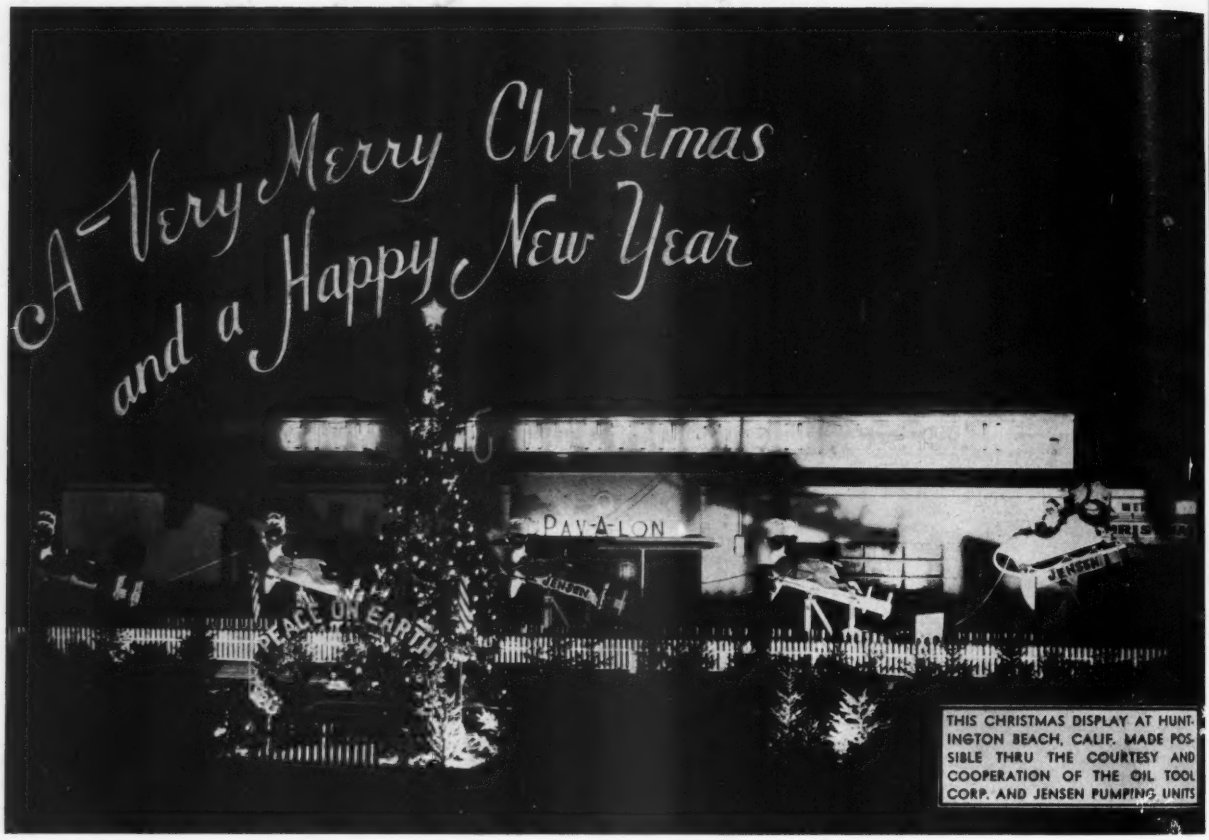

THIS CHRISTMAS DISPLAY AT HUNTINGTON BEACH, CALIF. MADE POSSIBLE THRU THE COURTESY AND COOPERATION OF THE OIL TOOL CORP. AND JENSEN PUMPING UNITS

To You All

The Oil Tool Corporation

3075 Cherry Ave. **Long Beach 7, Calif.**

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